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Development of Candidate Crew Coordination Training Methods and Materials

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) This technical report covers the development of aircrew coordination training methods and materials for the United States Army. The development of two Aircrew Coordination Exportable Training Packages, candidate and final, is discussed. The candidate Aircrew Coordination Exportable Training Package was developed to provide an illustrative context for the field validation of a prototype methodology for training and evaluating Army aircrew coordination skills in the helicopter cockpit. Development of the field exportable evaluation package is discussed in a companion report (Development of Crew Coordination Evaluation Methods and Materials; Grubb et al., 1993). Lessons learned from the field validation testbed were then used to develop the final Aircrew Coordination Exportable Training Package. The report concludes by providing recommendations for the improvement, fielding, and use of the Army Aviation Aircrew Coordination Exportable Training Package, which was provided separately to ARI in a companion report (Aircrew Coordination Exportable Training Package for Army Aviation; (Pawlik et al., 1992).					
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DEVELOPMENT OF CANDIDATE CREW COORDINATION TRAINING METHODS AND MATERIALS

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DEVELOPMENT OF CANDIDATE CREW COORDINATION TRAINING METHODS AND MATERIALS

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Development of Candidate Crew Coordination Training Methods and Materials

Introduction

During the 1970s, the commercial airline industry found that mechanically sound aircraft were crashing for no apparent reason. With the advent of cockpit voice recorders, flight data recorders, and more systematic accident investigation methods, the industry realized the magnitude of the problem: Pilot judgement, crew management, and situational awareness were all factors in the crashes. During the same period, human factors researchers began suggesting the possibility of formally teaching cockpit management tasks (Diehl, 1991).

The military services noted the lessons learned by the airline industry and adopted various programs based on commercially available cockpit resource management or line oriented flight training programs. Most of these programs embodied methods that taught attention management issues, crew management issues, stress management concepts, attitude management concepts, decision making, and risk management issues; however, there was no structured approach to sequencing such subjects in the various programs. Although many of the concepts taught in such courses were broadly applicable to military operations, the Army aviation environment required that they be modified to make them operationally and culturally acceptable.

In modifying the airline crew coordination concepts for Army aviation application, a primary consideration was the contrast in flight environments. Army aircrews fly under unforgiving tactical and environmental conditions, in which acceptable courses of action to meet contingencies and unforeseen events often need to be determined within seconds. In contrast, commercial aircraft operate primarily in the positive control zone, in which emergencies and other types of unexpected events generally unfold over longer periods of time. For example, consider the time frame within which a Boeing 747 captain must deal with shutting down an engine at 35,000 feet. A similar time frame is not available to an Army pilot-in-command whose helicopter has incurred an engine failure 50 feet above the trees under night vision goggles.

In line with the rapid reaction time required of the Army aviator, a second distinction from the commercial world was recognized: Commercial pilots are traditionally trained in standardized procedures for each flight deck position. These standardized procedures are then reinforced through Crew Resource Management training. Army pilots are not so trained; each is trained and qualified to fly the aircraft. Several crewed aircraft do not specify duties for the pilot not flying. As a result, the Army version of crew coordination training required the development and incorporation of standardized procedures as well as terminology.

Although the Army recognized the value of the commercial crew coordination training programs, the contrast in operational environments and standardization training convinced training developers that a different approach to teaching crew coordination was required for its flight crews.

Recognizing the disparity between the commercial and military flying environments, the US Army Research Institute Aviation Research and Development Activity (ARIARDA) initiated a long-range research program (FY 89-95) (Leedom, undated) to (a) diagnose specific human error factors prevalent in Army aviation and ground operation accidents and (b) identify promising strategies for reducing such accident causation factors through improved soldier selection, training, leadership, and organization. This research effort supported the Army's growing introduction of high technology, crewed systems into the force structure. To achieve the long-range objectives of crew coordination training research, ARIARDA tasked Dynamics Research Corporation (DRC) to develop reliable measures of crew coordination. This initial tasking is referred to as the Crew Coordination I research effort.

The result of the Crew Coordination I research effort was a validated crew coordination measurement suite. In developing the measurement suite, a key concept was the Resource Integration for Crewed Systems (RICS) Model (Simon, 1990). The RICS Model provided the framework for describing cockpit behaviors required to accomplish mission taskings. Empirical findings supported the validity of the RICS Model; e.g., a significant correlation was found between crew coordination behaviors and mission performance criteria. Together, the measurement suite and RICS model indicated that the simulator-intensive, scenario-driven approach to crew coordination training that ARI recommended had great potential benefit. ARIARDA, therefore, initiated the Crew Coordination II research effort to provide a proof-of-concept demonstration and field validation of a prototype methodology for (a) training and evaluating Army aircrew coordination skills in the helicopter cockpit and (b) relating skill improvements to mission effectiveness and flight safety.

Purpose

The purpose of this technical report is to document the work performed by DRC to develop aircrew coordination training methods and materials. Although the examples used in the training materials are specific to the work performed during FY92, the methods and materials are designed to be generalizable to any crewed system. The training materials developed in support of aircrew coordination training have been provided to ARIARDA (Pawlik, Simon, Grubb, & Zeller, 1992 a&b).

Overview

This technical report reviews crew coordination courses used by the airlines and other agencies; summarizes the guidance provided by the United States Army Aviation Center (USAAVNC) Crew Coordination Working Group governing the preparation of Army candidate crew coordination training methods and materials; summarizes the development of the validation testbed training package (Pawlik et al., 1992a); provides the validation testbed lessons learned during application of the candidate crew coordination training methods and materials; describes the final field exportable training package resulting from the testbed field application (Pawlik et al., 1992b); and provides recommendations to USAAVNC for improving the final field exportable training package.

The report traces the historical flow of crew coordination research and training from the early pioneering work with simulators done by Northwest Airlines through the delivery to the US Army of the validated, standardized, field exportable aircrew coordination training program. (Figure 1)

Summary and USAAVNC Review of Previous Training Programs by Airlines and Other Agencies

The following paragraphs discuss aircrew coordination programs used by the airlines and other agencies, describe the unique characteristics of each, identify those elements incorporated into the candidate training materials, and summarize the USAAVNC aircrew coordination course selection review process.

Northwest Airlines - Line Oriented Flight Training

The program that Northwest Airlines began in the early 1970s was known as the Coordinated Crew Training Program. With the advent of simulators, Northwest used the devices to improve the training of its flight crews. Crew training was accomplished by flying missions paralleling actual operations in either the aircraft or the simulator; hence, the terms line/line oriented flight training, or Line/LOFT. In 1975, Northwest petitioned the

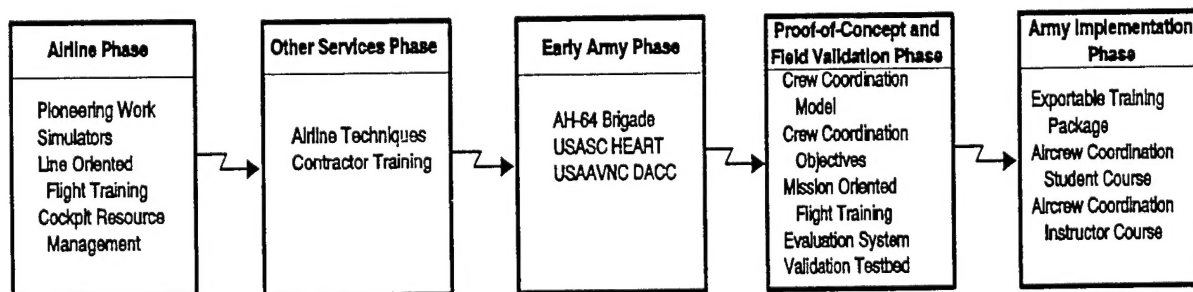


Figure 1. Crew Coordination from airlines to Army.

Federal Aviation Administration to begin using this new type of training. The contextual basis was now in place for the development of cockpit resource management programs of instruction, now referred to as Crew Resource Management, or CRM. Three airlines currently have fully integrated recurrent CRM/LOFT training programs: United, Pan Am, and Delta.

To evaluate the effectiveness of crew coordination training, a cooperative agreement was entered into between NASA-Ames Research Center and the University of Texas (Crew Performance Project). Research into the reinforcement and evaluation of CRM was undertaken by Dr. Robert L. Helmreich, which led to the development of the NASA/UT Line/LOFT Worksheet and an accompanying Check Airman/LOFT Instructor Reference Manual (Helmreich, Wihelm, Kello, & Taggart, 1990).

DRC modified the Line/LOFT Worksheet and incorporated it into the measurement suite developed under the Crew Coordination I research effort. The modified instrument was designated as the Aircrew Coordination Evaluation (ACE) Checklist.

An attitude measuring instrument, the Cockpit Management Attitude Questionnaire (CMAQ), was also developed by Dr. Helmreich to measure shifts in attitude toward crew coordination after training. DRC modified the CMAQ to reflect Army terminology, expanded it to reflect Army operations, and included it in the Crew Coordination I measurement suite initially as the Military CMAQ, and in final form as the Army Aviation Crewmember Questionnaire.

US Navy - Aircrew Coordination Training

Among the military services, the US Air Force's Military Airlift Command recognized the value of the commercial airline aircrew coordination training and collaborated with the NASA-Ames Research Center in sponsoring CRM Workshops (Orlady & Foushee, 1987). While the Military Airlift Command operates in a flight environment similar to that of the airline industry, other services do not. The US Navy, therefore, invested in an aircrew coordination training program developed by Simuflite Training International and the Allen Corporation of America (Naval Training Systems Command, undated). This course did not incorporate a hands-on phase to practice the crew coordination principles learned in the classroom, focused heavily on changing attitudes, and did not provide enough skills and behavior-oriented training. However, DRC and USAAVNC used several of its concepts, such as the critical success factors/elements and stress articles and exercises, to develop the candidate aircrew coordination training materials.

US ARMY AH-64 Training Brigade - Aircrew Coordination

Building on the U.S. Air Force's and Navy's crew coordination experience, the Army's AH-64 Training Brigade, Fort

Hood, TX, contracted with CAE-Link for the crew coordination training of its Apache gunship crews (United States Army III Corps, 1991). Although the AH-64 crew coordination training did not contain a hands-on phase, it did incorporate an instructor training course to prepare facilitators to present aircrew coordination instruction. Concepts such as the Two-Challenge Rule, excessive professional courtesy, and most conservative response were employed by DRC and USAAVNC in the development of the candidate aircrew coordination training materials.

U.S. Army Safety Center - Human Error Accident Reduction Training (HEART)

Although not aircrew coordination training per se, USASC contracted for HEART (Geis & Alvarado, 1990). The purpose of HEART was to train aviation safety officers as facilitators to present aviation accident prevention subjects to Army aircrews. Many of the subjects covered by HEART were part of other courses reviewed.

USAAVNC - Dynamics of Communication and Coordination (DACC)

USAAVNC currently employs the DACC course in its resident courses (United States Army Aviation Center, 1985). USAAVNC also provides the DACC in an exportable format for use by the field to train aircrews in crew coordination fundamentals. The thrust of the course is using small groups to solve several nonflight-related problems presented by the facilitator. As with previous courses, DRC used several of the concepts employed in the DACC, such as advocacy, assertion, problem solving, decision making, small work groups, and the exportable training format to develop the candidate aircrew coordination training materials.

ARI/DRC - Cockpit Resource Management for Unit Aviators Course (CRM-UA)

One of the Crew Coordination I deliverables was a detailed outline for an aircrew coordination training course based on the ARIARDA and DRC research findings. Entitled the "Cockpit Resource Management for Unit Aviators Course" (Pawlik, 1990), the course incorporated many of the best features of other crew coordination courses, together with the hands-on, scenario-driven, mission-oriented training approach ARI recommended and validated during the Crew Coordination I testbed. The CRM-UA differentiated itself from other crew coordination courses by incorporating the hands-on phase conducted in either the aircraft or simulator. The other major difference was that the CRM-UA focused on the training of crew coordination behaviors and skills instead of focusing primarily on the changing of attitudes. This approach was justified by the Crew Coordination I findings, which established crew coordination behavior as a strong predictor of mission performance (Simon, 1991). To select and sequence course topics, the CRM-UA utilized the framework provided by the RICS Model. The RICS Model was subsequently retitled as the Crew Coordination

Model to better describe its purpose in the present context (Figure 2) (Simon, 1992).

Integral to the Crew Coordination Model are four on-going crew mission responsibilities performed for a typical crewed system:

- Plan (Mission planning/replanning)
- Assess (Situational awareness)
- Resolve (Decision making/problem solving)
- Execute (Operational task execution)

Central to the Crew Coordination Model's on-going crew mission responsibilities are the five behavioral Crew Coordination Objectives:

- Establish and maintain team relationships
- Mission planning and rehearsal
- Establish and maintain workload levels
- Exchange mission information
- Cross-monitor performance

The Crew Coordination Model initially had four Crew Coordination Objectives; Crew Coordination Objective 2, mission planning and rehearsal, was added because of its marked affect on aircrew performance observed during the Crew Coordination I testbed (Thordsen, 1990).

In addition to the on-going crew mission responsibilities and Crew Coordination Objectives that compose the Crew Coordination Model, two other components of the Crew Coordination I measurement suite were employed in constructing the CRM-UA course. These components were the Aircrew Coordination Evaluation (ACE) Checklist and Aircrew Training Manual (ATM) Task 1071.

The ACE Checklist (Appendix A) was a modification of the Line/LOFT Worksheet developed for the NASA/UT Crew Performance Project (Helmreich et al., 1990). The ACE contained 19 behavioral dimensions used by Crew Coordination I testbed evaluators to rate crewmembers on the crew coordination aspects of mission performance. To train crew coordination evaluators, evaluation instruction based on the ACE Checklist was included in the CRM-UA.

ATM Task 1071 (Perform as a Crew Member) (Appendix B) was revised to provide the standards used by testbed evaluators to rate the accomplishment of the crew coordination component of the ATM task; technical flying skill was the other component. Grading a testbed crew B or lower on an ATM task due to poor crew coordination required citation of one or more of the 11 ATM Task 1071 standards. To provide the means for exercising the evaluation system, 15 aircrew coordination-intensive ATM tasks (Table 1) were selected, rewritten, and included in the Crew Coordination I evaluation scenario. To provide evaluators with

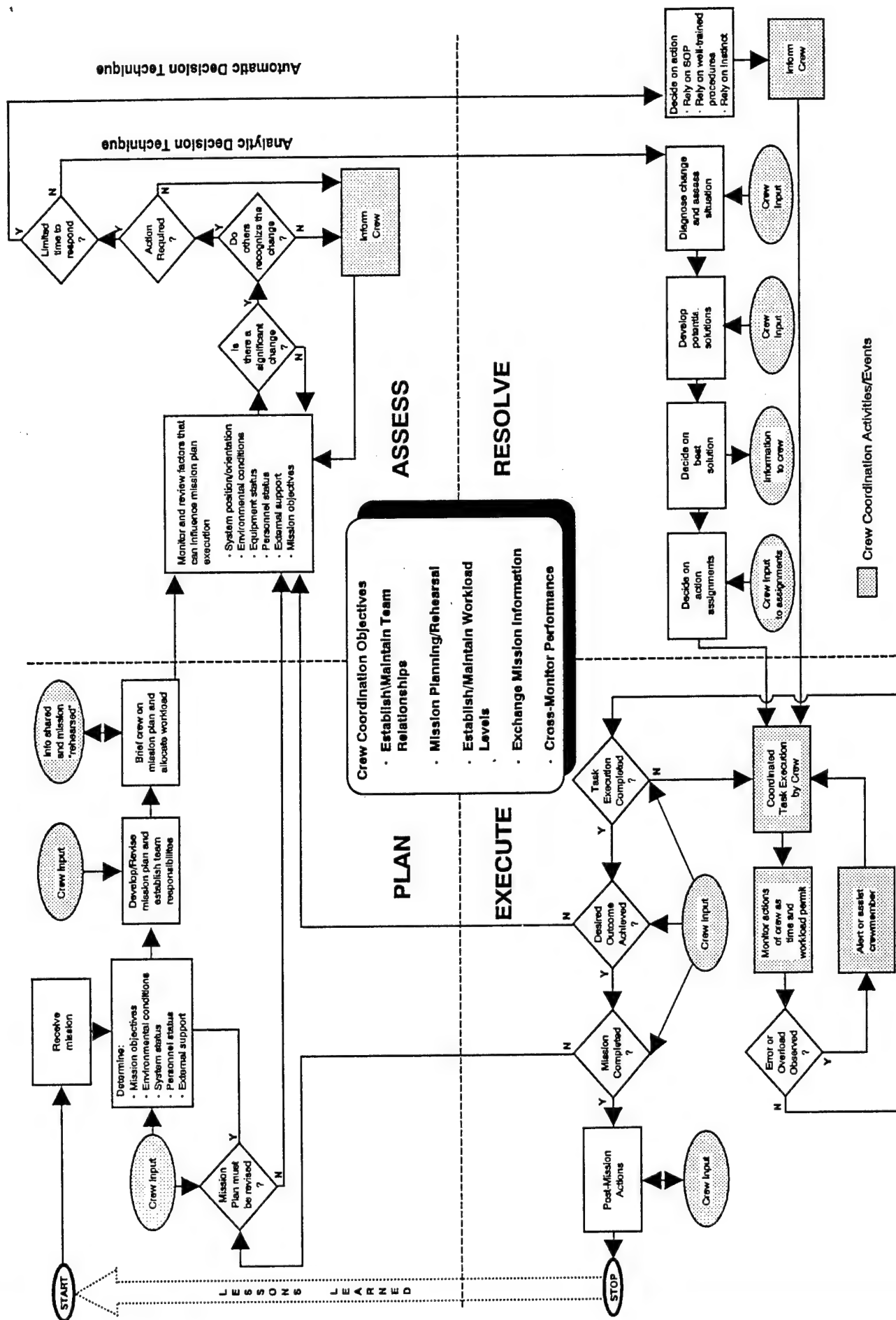


Figure 2. Crew Coordination Model.

Table 1

Aircrew Coordination-Intensive ATM Tasks

ATM Task	Task title
1001	Plan a VFR Flight
1002	Plan an IFR Flight
1007	Perform Engine Start, Run-up, and Before-Takeoff Checks
1015	Perform Ground Taxi
1017	Perform Hovering Flight
1028	Perform VMC Approach
1031	Perform Confined Area Operations
1053	Perform Simulated Engine Failure at Altitude
1068	Describe or Perform Emergency Procedures
1071	Perform as a Crewmember (Cockpit Teamwork)
1098	Perform After-Landing Tasks
2009	Perform Multiaircraft Operations
2016	Perform External Load Operations
2081	Perform Terrain Flight
2084	Perform Terrain Flight Approach

the required crew coordination standards, instruction on ATM Task 1071 was included in the CRM-UA.

In summary, the CRM-UA was built on a validated crew coordination model. It used concepts that were validated in an Army aviation environment utilizing Army aviation crews. The CRM-UA provided an approach to Army crew coordination training that was unique, culturally correct, and technically sound.

Actions Taken by the USAAVNC Working Group During
the Review of Aircrew Coordination Training Programs

When tasked to develop a crew coordination course for the Army, the USAAVNC Working Group conducted a review of the existing crew coordination courses to determine their usefulness.

A summary of the actions that the USAAVNC Working Group took is at Table 2.

Table 2

USAAVNC Working Group's Crew Coordination Course Review Actions

Course	Reviewed Course Material	Attended Course	Remarks
US Navy	Y	N	Reviewed by DRC
US Army AH-64 Training Brigade	Y	Y	Reviewed by DRC; attended by USAAVNC and DRC representatives
USASC HEART	Y	Y	Reviewed and attended by USAAVNC representatives
USAAVNC DACC	Y	Y	Reviewed by DRC; course conducted by USAAVNC for the Working Group
ARI/DRC CRM- UA	Y	N	Reviewed by USAAVNC Working Group

During the course review phase, the USAAVNC Working Group identified the best features of each course reviewed. After selecting the CRM-UA as the basis for the Army aircrew coordination training program, the USAAVNC Working Group directed DRC to incorporate the identified features into the Army aircrew coordination course. Other guidance that the USAAVNC Working Group provided to the project staff is presented in the following paragraphs.

Summary of Guidance Provided by the USAAVNC Working Group

This section discusses the USAAVNC Working Group conceptual, administrative, and doctrinal guidance provided to the project staff to assist in preparing the candidate training methods and materials for crew coordination training.

USAAVNC Working Group's Conceptual Guidance

During the interim between the Crew Coordination I and II projects, USAAVNC had assimilated crew coordination concepts and accident investigation analyses findings into several aviation doctrinal publications. To ensure that the crew coordination program reflected the most current doctrinal approach, the USAAVNC Working Group directed several significant changes affecting the conceptual framework of the CRM-UA course. A summary of the USAAVNC Working Group conceptual guidance is provided at Table 3. A detailed discussion is provided in the following paragraphs.

Table 3

USAAVNC Working Group's Conceptual Guidance

Concern	Guidance
Aircrew Training Manual Task 1071 (Perform as a Crewmember)	Eliminate. Crew coordination standards now in ATM tasks; use Basic Qualities (BQs) as task and mission-level crew coordination standards.
Aircrew Coordination Evaluation (ACE) Checklist	Reduce the 19 ACE "dimensions" to 13 Aircrew Coordination Basic Qualities; relate the BQs to the Crew Coordination Objectives; use BQs as course subject matter organizers.
Crew Coordination Elements	Use in crew coordination training; show how incorporated in ATM tasks; use ATM tasks to teach BQs.
Crew Coordination Objectives	Retain without modification.
Cross-Walk Chart	Do not use. (Note: Cross-Walk Chart provided to instructors and aircrews during testbed debriefings by USAAVNC Working Group).
Crew Coordination in Army Aviation Graphic	Use to explain relationship of crew coordination components.
Resource Integration for Crewed Systems (RICS) Model	Do not introduce new terminology; use familiar terms; rename RICS to Crew Coordination Model; use block versus detailed model.
Crew Coordination Model On-Going Crew Mission Responsibilities	Retain "Plan" responsibility; rename Situation Awareness to Assess Decision Making and Problem Solving to Resolve, and Operational Execution to Execute.
Subject Organization	Show BQs as bridge between Crew Coordination Elements and the Crew Coordination Objectives; provide up to 1 hour instruction on each BQ.
Crew Coordination Evaluation	Include variant of candidate exportable evaluation package (Grubb, Simon, & Zeller, 1992) in the candidate exportable training package (Pawlik et al., 1992a); teach unit instructors to use the evaluation package during the Instructor Course ¹ .

¹The Instructor Course mentioned here and throughout this report is referred to as the Trainer Course in both the candidate (Pawlik et al., 1992a) and final (Pawlik et al., 1992b) field exportable training packages. Subsequent to the publication of these training packages, the term Trainer Course was redefined to mean the course that USAAVNC needs to develop to train certified trainers who will then teach the Aircrew Coordination Instructor Course to unit instructors. This action necessitated renaming the course used to train the unit instructors to the Instructor Course. This change will be reflected in future editions of the Aircrew Coordination Exportable Training Package.

Table 3

USAAVNC Working Group's Conceptual Guidance (Continued)

Concern	Guidance
Hands-on component	Essential; simulator or aircraft; crawl-walk-run concept; add the pretraining and post-training evaluation missions to the Student Course Program of Instruction if testbed results support such action.
Videotaping	Videotape aircrew coordination training missions to validate training benefits of videotape review during instructor debriefings; videotape premission planning and rehearsal, simulator or flight, and crew-level after-action review activities.
Exportable Training Package (Pawlik et al., 1992a)	Include two courses: Aircrew Coordination Student Course ² and Aircrew Coordination Instructor Course.

Discussion of USAAVNC Working Group's Conceptual Guidance

The USAAVNC Working Group directed that the crew coordination training be as operationally specific as possible, and that the use of academic or theoretical terminology, issues, and discussions be minimized to preclude a "touchy-feely" aspect. To accomplish these goals, the training was to (a) make extensive reference to TC 1-210 and the revised ATMs and (b) be based on objectively defined evaluation standards to dispel criticisms associated with previous crew coordination courses and programs. Accordingly, the USAAVNC Working Group directed several major changes, enhancements, and title revisions to the CRM-UA. Changes included eliminating ATM Task 1071, developing Basic Qualities, incorporating Crew Coordination Elements, and clarifying the relationship among the crew coordination components. Enhancements included aligning the Basic Qualities under their appropriate Crew Coordination Objective, including the candidate evaluation methods and materials in the candidate

²The Student Course mentioned here and throughout this report is referred to as the Aircrew Coordination Course in the final field exportable training package (Pawlik et al., 1992b). Subsequent to the publication of the final training package, the Aircrew Coordination Course was renamed to positively identify it as the aircrew coordination course used to instruct the student aircrews. In conjunction with previously mentioned changes, the three courses used to teach crew coordination are resultantly named the Trainer, Instructor, and Student Courses, thereby eliminating any confusion as to their use. These changes will be reflected in future editions of the Aircrew Coordination Exportable Training Package.

training materials, and adding simulator or flight missions to the training syllabus.

An important factor that must be noted here is the previously mentioned revision of the ATMs. Prior to 1992, ATMs were written from the individual pilot's perspective. The revised ATMs placed the emphasis on the crew. Crew coordination actions with respect to standardized communications and workload distribution and management were now incorporated into each ATM task. Crew coordination was also made a standard for each of the ATM tasks. Although the ATM tasks spelled out the crew coordination actions, how to implement or evaluate them was not addressed. In effect, the promulgation of the revised ATMs created the need for a crew coordination training program to accompany their distribution to the field. Without such training, it would be difficult for aviation commanders to fully implement the new training and evaluation standards contained in the ATMs.

Because the Army ATMs were revised to include aircrew coordination standards in every task, ATM Task 1071 was eliminated and replaced with a behaviorally-anchored rating system (BARS) to train and evaluate crew coordination. A set of 13 behaviorally-anchored ratings, called Crew Coordination Basic Qualities (BQs), was developed (Table 4). The term "basic quality" was already in use in the USAAVNC resident flying courses to identify shortcomings in task performance; hence, IPs were familiar with them. Of the 13 BQs, 12 were derived from the 1990 version of the ACE. The 13th BQ, Crew-level After-action Reviews Accomplished, was added by the USAAVNC Working Group to capture the lessons learned from each mission.

These actions provided the Army with the basis for a candidate evaluation system to measure crew performance at both the ATM task (micro) and overall mission (macro) levels. The BQs replaced ATM Task 1071 as a major subject matter organizer for crew coordination training.

The USAAVNC adopted an additional concept: the Crew Coordination Elements. As a result of a 1990 USASC and ARI accident analysis (Leedom, undated), USAAVNC identified eight Crew Coordination Elements (Table 5), which were incorporated into Training Circular (TC) 1-210 (Commander's Guide to Individual and Crew Training) (Department of the Army, 1992), which had been rewritten to reflect the crew approach to aircrew training. Because the Crew Coordination Elements had been incorporated into the training circular, the USAAVNC Working Group directed that they be included in the Army crew coordination training program.

Table 4

Crew Coordination Basic Qualities

-
1. Establish and maintain flight team leadership and crew climate
 2. Pre-mission planning and rehearsal accomplished
 3. Selection of appropriate decision making techniques
 4. Prioritize actions and distribute workload
 5. Management of unexpected events
 6. Statements and directives clear, timely, relevant, complete, and verified
 7. Maintenance of mission situational awareness
 8. Decisions and actions communicated and acknowledged
 9. Supporting information and actions sought from crew
 10. Crewmember actions mutually cross-monitored
 11. Supporting information and actions offered by crew
 12. Advocacy and assertion practiced
 13. Crew-level after-action reviews accomplished
-

Table 5

Crew Coordination Elements

-
1. Communicate positively
 2. Direct assistance
 3. Announce actions
 4. Offer assistance
 5. Acknowledge actions
 6. Be explicit
 7. Provide aircraft control and obstacle advisories
 8. Coordinate action sequence and timing
-

The relationship of the Crew Coordination Objectives, BQs, and Crew Coordination Elements is depicted in the Cross-Walk Chart (Figure 3). The Crew Coordination in Army Aviation Graphic (Figure 4) depicts a similar relationship. The graphic additionally shows the relationship of the crew coordination components to the on-going crew mission responsibilities of the Crew Coordination Model and has, at its core, performance of the ATM Tasks. In effect, from center to perimeter, the graphic portrays the crew coordination components' order of instruction that the USAAVNC Working Group prescribed.

The USAAVNC Working Group also directed three enhancements to the Aircrew Coordination Student Course:

- Align the BQs under their appropriate Crew Coordination Objective (Table 6).
- Incorporate candidate evaluation methods and materials for initial crew coordination training into the candidate aircrew coordination training materials.
- Add one training mission in the simulator or aircraft to the one training mission previously included in the CRM-UA.

Three missions were ultimately added to the crew coordination course by the USAAVNC Working Group: a pretraining evaluation mission, the additional training mission, and a post-training evaluation mission. The pretraining and post-training evaluation missions were elements of the validation testbed evaluation program. If justified by the testbed results, the pre- and post-training rides were to be made part of the final Student Course. Thus, four missions in the aircrew coordination training were planned for the Fort Campbell Crew Coordination II validation testbed. Except for the pretraining mission (baseline evaluation), the missions were to conform to the Crawl-Walk-Run training philosophy:

- Crawl mission - an extension of the classroom during which the instructor provides instruction and answers questions as the mission progresses.
- Walk mission - a mission during which the instructor observes the crew but intervenes only if they fail to use, or if they violate, crew coordination principles.
- Run mission - a mission during which the evaluator observes and evaluates crew performance but does not intervene except in the case of a life-threatening situation.

The USAAVNC Working Group recommended that the training and evaluation missions be videotaped and that the videotapes be used by the instructors and evaluators during their debriefing of the crews. Debriefings were to cover crewmember activities from premission planning through the crew-level after-action review.

RELATIONSHIP OF ATM AIRCREW COORDINATION ELEMENTS, BASIC QUALITIES, AND AIRCREW COORDINATION OBJECTIVES

ATM Aircrew Coordination Elements							Aircrew Coordination Basic Qualities					Crew Coordination Objectives													
Communicate Positively	Direct Assistance	Announce Actions	Offer Assistance	Acknowledge Actions	Be Explicit	Aircraft Control and Obstacle Advisories	Action Sequence/Timing	1. Establish and maintain flight team leadership and crew climate	2. Pre-mission planning and rehearsal accomplished	3. Application of appropriate decision making techniques	4. Prioritize actions and distribute workload	5. Management of unexpected events	6. Statements and directives clear, timely, relevant, complete, and verified	7. Maintenance of mission situational awareness	8. Decisions and actions communicated and acknowledged	9. Supporting information and actions sought from crew	10. Crewmember actions mutually cross-monitored	11. Supporting information and actions offered by crew	12. Advocacy and assertion practiced	13. Crew-level after-action reviews accomplished	Establish and Maintain Team Relationships	Mission Planning and Rehearsal	Establish and Maintain Workload Levels	Exchange Mission Information	Cross-Monitor Performance
																					XX				
							X															XX			
	X																					XX	X		
	X		X																				XX		
			X			X						X											XX		
XX				X	XX																			XX	
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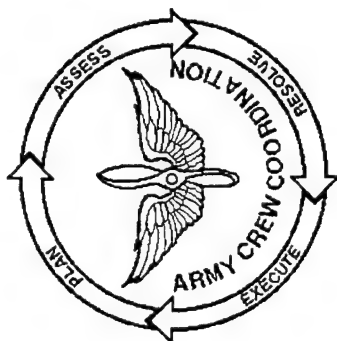


Figure 3. Cross-walk chart

Crew Coordination in Army Aviation

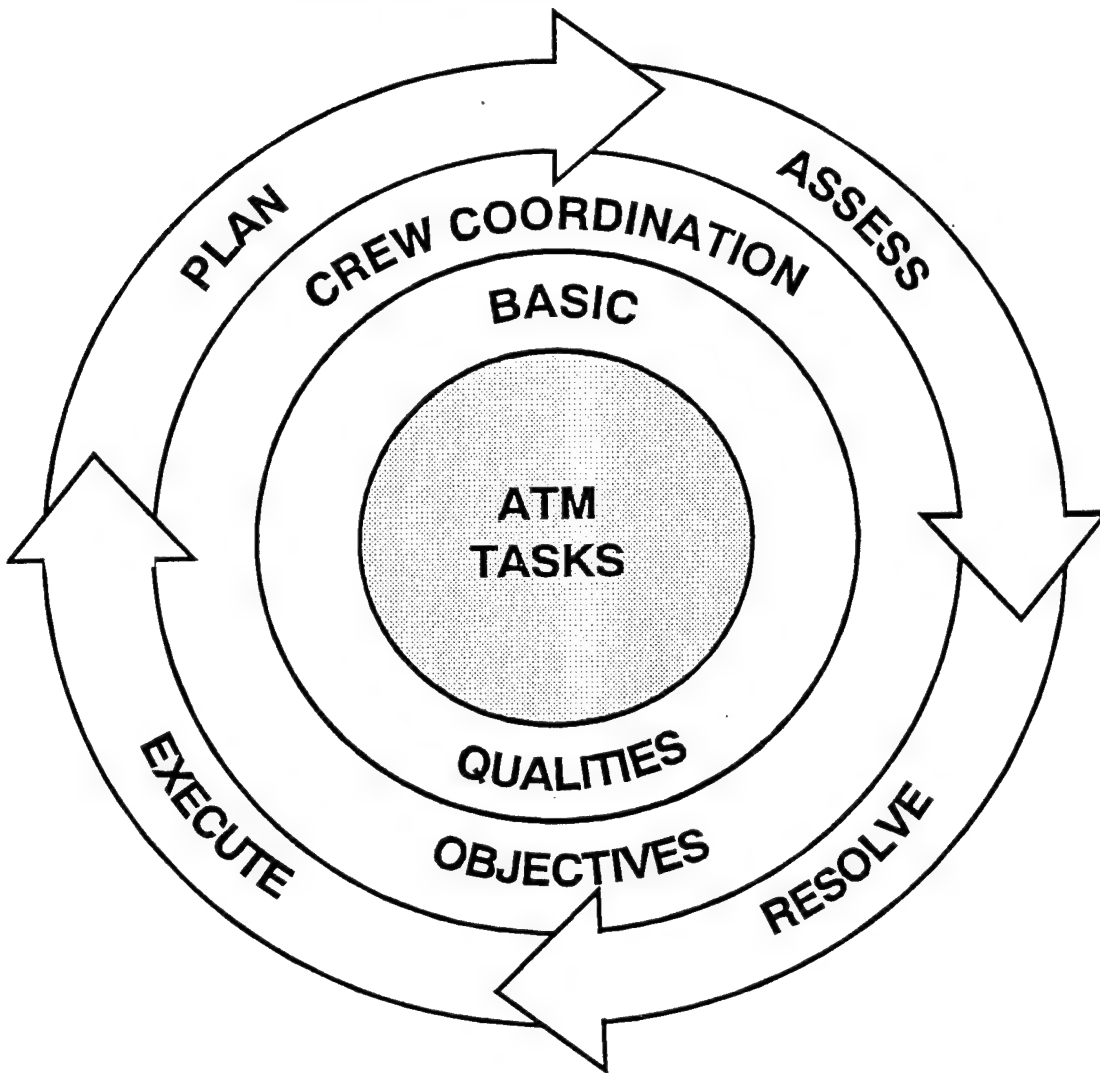


Figure 4. Crew Coordination in Army aviation graphic.

Lastly, the USAAVNC Working Group directed that the CRM-UA be redesignated as the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) and that it would comprise two courses: The Aircrew Coordination Instructor Course and the Aircrew Coordination Student Course. The purpose of the Aircrew Coordination Instructor Course would be to train unit instructors to teach the Aircrew Coordination Student Course. The purpose of the Aircrew Coordination Student Course would be to train aircrews, both rated and nonrated crewmembers, in the theory and application of crew coordination principles.

Table 6

Basic Qualities Organized by Crew Coordination Objective

CCO 1.	Establish and maintain team relationships
BQ 1.	Establish and maintain flight team leadership and crew climate
CCO 2.	Mission planning and rehearsal
BQ 2.	Prepermission planning and rehearsal
BQ 3.	Selection of appropriate decision making techniques
CCO 3.	Establish and maintain workload levels
BQ 4.	Prioritize actions and distribute workload
BQ 5.	Management of unexpected events
CCO 4.	Exchange mission information
BQ 6.	Statements and directives clear, timely, relevant complete, and verified
BQ 7.	Maintenance of mission situational awareness
BQ 8.	Decisions and actions communicated and acknowledged
BQ 9.	Supporting information and actions sought from crew
CCO 5.	Cross-monitor performance
BQ 10.	Crewmember actions mutually cross-monitored
BQ 11.	Supporting information and actions offered by crew
BQ 12.	Advocacy and assertion practiced
BQ 13.	Crew-level after-action reviews accomplished

USAAVNC Working Group's Administrative Guidance

The USAAVNC Working Group provided the crew coordination training developers with the administrative guidance needed to develop the aircrew coordination training program. This guidance is discussed below and summarized at Table 7.

Length of Training

Aircrew Coordination Student Course. The course should provide up to 18 hours of academic training on the principles of crew coordination. The course should begin with an attention-getter (videotape of a crew coordination-related aviation

Table 7

USAAVNC Working Group's Administrative Guidance

Length of training	Student Course: 16 to 18 hours of academic instruction and two 5-hour training missions (26 to 28 hours total). Instructor Course: 24 hours of academic instruction and one 2-hour familiarization training mission (26 hours total).
Simulator or aircraft aircrew coordination training missions	Schedule 1.5 hours for premission planning and rehearsal; 1.75 hours simulator or flight time; and 1.75 hours crew-level after-action review and instructor debriefing time.
Size of classes	Student Course: Maximum of 16 rated and nonrated crewmembers. Instructor Course: Maximum of 8 to 10 instructors.
Instructor categories	Instructor Pilots (IP) as instructors and evaluators; unit trainers (UT) may supplement where insufficient IP assets; UTs do not evaluate pre- or post-training missions; IPs, UTs, or installation simulator personnel may be used to perform instructor operator (IO) duties.
Lesson plan format	Use four-element format to teach BQs: define, discuss, evaluate, and illustrate; use rating factors to teach, behavioral anchors to evaluate.
Evaluation criteria and guidance	Use candidate evaluation methods and materials; a "U" does not render an entire flight unsatisfactory.

accident) and introductory materials should be limited to not more than four hours. To adequately cover the simulator or flight training requirements, two missions at five hours per mission should be included. Total instruction for the Student Course should not exceed 28 hours (Figure 5, Table 8).

Aircrew Coordination Instructor Course. The course should provide up to 24 hours of academic training on the Methods of Instruction (MOI), principles of crew coordination, and crew coordination evaluation. The course should be introduced using the Student Course attention-getter. For the simulator or flight

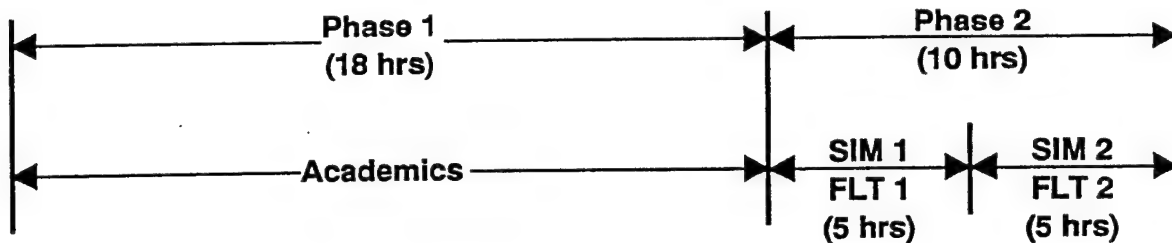


Figure 5. Aircrew Coordination Student Course structure (28 hours).

Table 8

Aircrew Coordination Student Course Simulator or Flight Training Missions

Number	Mission Category	Training Category
1	Pretraining	Run (Baseline evaluation)
2	Training	Crawl
3	Training	Walk
4	Post-training	Run (Final evaluation)

scenario familiarization phase, one two-hour mission should be included to demonstrate the type of scenarios flown in the Student Course. Total instruction for the Instructor Course should not exceed 26 hours (Figure 6).

Note: The Aircrew Coordination Instructor Course included the Aircrew Coordination Student Course academic phase as an integral instructional element.

Simulator or Flight Missions

Student course simulator or flight missions should be at least 5 hours in length. Each mission will consist of 1.5 hours premission planning and rehearsal, 1.75 hours flight/simulator time, and 1.75 hours after-action review. Because these times represent a departure from the standard simulator schedule, a new simulator schedule was developed (Table 9). Due to delays in travel to the flight line and preflighting, etc., similar

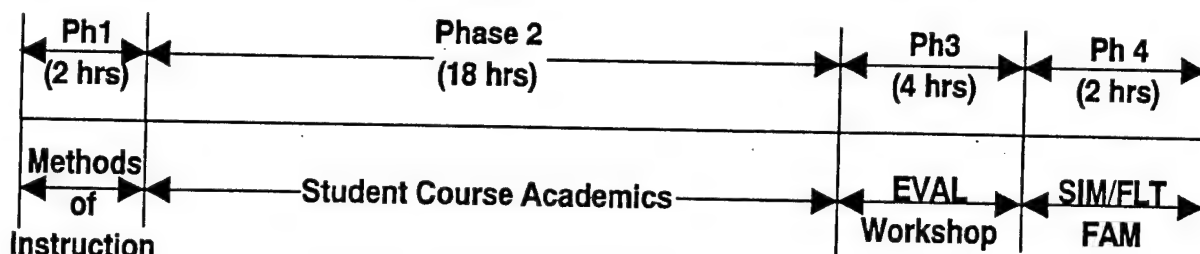


Figure 6. Aircrew Coordination Instructor Course structure (26 hours).

Table 9

Initial Crew Coordination Training Simulator Schedule

Period	Prepermission planning	Simulator flight	After-action review
1	0630 - 0800	0800 - 0945	0945 - 1130
2	0815 - 0945	0945 - 1130	1130 - 1315
3	1000 - 1130	1130 - 1315	1315 - 1500
4	1145 - 1315	1315 - 1500	1500 - 1645

aircraft flight schedules will have to be developed by each training organization to support aircrew coordination training.

Size of Classes

Aircrew Coordination Student Course. The class size should be limited to 16 crewmembers. Larger class sizes make it difficult to develop the interpersonal relationships necessary to internalize the crew coordination principles. Also affected would be the simulator or flight training tempo recommended at four crews per simulator per day.

Aircrew Coordination Instructor Course. The class size should be limited to 8 to 10 unit instructors. The smaller class size preserves the benefits inherent to the small group and does not affect the simulator or flight training tempo recommended at eight unit instructors (four crews) per simulator per day.

Unit Instructor Categories

Although the USAAVNC Working Group felt that IPs should teach and evaluate aircrew coordination, personnel constraints

could require that they be augmented with unit trainers (UTs). UTs would present classroom instruction, perform as an IO in the simulator, and instruct and evaluate the application of crew coordination principles during the two training missions. IPs would serve as crew coordination course directors, IOs, and evaluators for the pretraining (baseline) and post-training evaluation missions. IPs would also ensure that appropriate notations were made to student flight records to show they completed initial crew coordination training.

Lesson Plan Format

To teach each of the Basic Qualities (BQ), the USAAVNC Working Group prescribed the following four-element format (see Appendix C for an example):

- Define the BQ
- Discuss the BQ in terms of teaching points
- Describe the rating factors (performance criteria) to be used during crew coordination evaluation, and
- Provide case studies of each BQ for analysis by the students to determine violations or exemplary use of crew coordination principles (Appendix D).

Evaluation Criteria

The guidance contained in the Candidate Exportable Evaluation Package (Grubb, Simon, & Zeller, 1992), as applicable to initial crew coordination training, should be incorporated in the Instructor Course. Weighting of the crew coordination and technical flight skill elements of each ATM Task grade will be at the evaluator's discretion.

Evaluation Guidance

An unsatisfactory grade (U) for any one ATM task should not render the entire mission as unsatisfactory. This condition was prescribed for several reasons. First, because simulator-based crew coordination training had not been introduced Army-wide, no crew could fail an evaluation due to crew coordination until after the field implementation period. Second, because data had to be obtained for all data points for each participating aircrew, missions could not be curtailed; they had to be completed. In addition, individual ATM task grades were only one consideration in the overall grade for the entire mission. In this respect, even a ground strike or crash would not terminate the mission.

USAAVNC Working Group's Doctrinal Guidance

The USAAVNC Working Group directed that the following doctrinal guidance and training materials used by USAAVNC should be integrated into the candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a). The guidance is summarized in Table 10.

Army Doctrine

The USAAVNC Working Group wanted an Army perspective to be maintained throughout the development of crew coordination training methods and materials. Instructors and aircrews are more familiar with Army policies and procedures than with those of other services or the commercial sector.

TC 1-210 (Department of the Army, 1992)

TC 1-210 is the aviation commander's guide to individual and crew-level training. It provides the link between the individual training tasks and the unit collective training tasks composing the unit's mission essential task list (METL). Additionally, TC 1-210 defines the five Crew Coordination Objectives, which are the primary organizers for crew coordination principles taught in the Aircrew Coordination Student Course.

ATMs

The USAAVNC Working Group directed the use of training materials with which students are familiar. Instructors and aircrews are both very familiar with the ATMs. Also, because the Crew Coordination Elements were integrated into the ATM tasks, incorporating the ATMs into the Aircrew Coordination Program training materials was fundamental to the program's success.

Grade Slips

Grade slips used during initial crew coordination training should closely approximate those prescribed by the appropriate aircraft ATM. The grade slips used in the validation testbed were only slight modifications of the approved fielded version.

Evaluation System

The grading system taught to aircrew coordination evaluators during the Aircrew Coordination Instructor Course should be based on the field system that uses "S" or "U." However, to negate the restricted range problem and to complement the BQ rating system, the grades "S+" and "S-" should also be used for the testbed and the train-up. The rating system should include a scale from 1 to 7 with 1 being "Very Poor," 4 being "Acceptable," and 7 being "Superior." Evaluators should interpolate performance falling between these scalars. The evaluation system is described in Grubb and Simon (1993).

Table 10

USAAVNC Working Group's Doctrinal Guidance

Item of concern	Guidance
Army Doctrine	Use Army doctrine to develop crew coordination training materials; use other services or commercial sector references if Army guidance is not available.
Training Circular (TC) 1-210	Show relationship of BQs to Crew Coordination Objectives; establish crew coordination and battle-rostering as separate concepts.
Aircrew Training Manuals	Use ATM Tasks to teach BQs; stress Crew Coordination Elements of each task.
Grade Slips	Use modified DA Form 7121-R and 5700-R (as appropriate); provide for rating of BQs at task and mission levels.
Evaluation System	Use modified field grading system employing S+, S, S-, and U for tasks and overall mission; use behaviorally anchored rating system (1 to 7) to rate the BQs.
Crew Coordination Examples	Use Army examples from ASMIS; use case studies to highlight Crew Coordination Elements, BQs, and Crew Coordination Objectives.

Crew Coordination Examples

The USAAVNC Working Group directed DRC to use aviation accidents from the USASC Army Safety Management Information System (ASMIS) to portray examples of crew coordination. Two categories of accident examples should be provided: accidents listed by crew coordination errors and accidents listed by selected ATM Tasks (see Appendix E for examples of the two categories of accidents). The training materials, therefore, included 46 written case studies and 9 videotaped accidents. Case studies for student analysis were organized by Crew Coordination Objective, BQ, type aircraft and, for multiple aircraft occurrences, by USASC case number. Owing to a lack of Army video examples for two of the BQs, civilian examples were used.

Development of the Validation Testbed Training Package (Pawlik et al., 1992a)

This section discusses the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a), its two component courses, supporting appendices, and crew coordination reference book used in the validation testbed.

General

The Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) was initially envisioned as a single course distributed per standard fielding practices. As development progressed and the interrelationships between the components of crew coordination were defined, it became apparent that unit instructors would need specialized training to teach the course. The USAAVNC Working Group, therefore, directed that an aircrew coordination instructor course be developed to train unit instructors in both the academic and evaluative aspects of crew coordination. The development effort, therefore, entailed the preparation of a Candidate Aircrew Coordination Exportable Training Package having the following three elements:

- The Aircrew Coordination Exportable Training Package General Information
- The Aircrew Coordination Instructor Course, and
- The Aircrew Coordination Student Course

Each of these three elements will be discussed in the following paragraphs.

Development of the Candidate Aircrew Coordination Exportable Training Package General Information Element (Pawlik et al., 1992a)

The General Information element was developed to provide a description of the Candidate Aircrew Coordination Exportable Training Package and to prescribe its use by trainers, instructors, and students.

Description of the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a)

The description of the Candidate Aircrew Coordination Exportable Training Package includes Volumes 1 and 2 and the associated training aids.

Volume 1, The Instructor Guide, has three major parts and contains the supporting appendices. The three major parts are each separately described in the General Information element.

- The Aircrew Coordination Instructor Course (Part A)

- The Aircrew Coordination Student Course (Part B)
- The Student Handout (Part C)

Volume 2, The Reference Book, is described next. It contains the supporting information necessary for instructor personnel to conduct either the Instructor or Student Course. It is a valuable source of information for review during the course, during crew coordination continuation training, and prior to annual crew readiness level ratings.

Use of the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a)

Following the description of the Candidate Aircrew Coordination Exportable Training Package, the use of the Instructor and Student courses is prescribed. First, the purpose of each course is stated; instructors are then stepped through each action necessary to prepare, conduct, and evaluate the training.

Development of the Aircrew Coordination Student Course

The Aircrew Coordination Student Course was the first major part of the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) to be developed. In the following paragraphs, we will discuss the development of the academic and simulator or flight training phases of the Student Course. For Student Course structure, see Figure 5.

Development of the Student Course Academic Phase

During the 1990 Crew Coordination I testbed at Fort Campbell, KY, there was no standardized, Army-wide, aircrew coordination course to serve as the illustrative context within which to validate the measurement suite. The CRM-UA, developed subsequent to the Crew Coordination I testbed, was built on those crew coordination concepts and principles empirically demonstrated to be effective. It was, therefore, a logical starting point from which to develop the candidate crew coordination methods and materials that would provide the illustrative context for validating the Crew Coordination II prototype evaluation methodology.

In developing the academic phase of the Aircrew Coordination Student Course, an "attention-getter" (videotaped aviation accident) preceded the course introduction. The introductory material, including terminal and enabling learning objectives, did not exceed four hours. Both of these conditions were in compliance with the USAAVNC Working Group guidance. Immediately following the introduction, student interest was generated by providing a brief overview of the four-element BQ teaching process. The remaining 14 hours of academics was then used to teach the 13 BQs, summarize the training, and introduce the

simulator or flight training phase. To support the academic phase of both the Student and Instructor Courses, viewgraphs, case studies, a videotape, practical exercises, a background reading file, and a lesson plan were developed. The development of each of these items is discussed below.

Viewgraphs. Viewgraphs were prepared in bulletized format on clear plastic transparencies. Detailed hardcopies of selected viewgraphs were incorporated into the Student Handout for ease of reference during the course. Separate identifiers were provided for the viewgraphs supporting each course, e.g., S-VG 01 for the Student Course and T-VG 01 for the Aircrew Coordination Trainer, now the Instructor, Course.

Case studies. Case studies were prepared to illustrate crew performance for each BQ. For the instructors, case studies included discussion points covering the applicable Crew Coordination Element, BQ, and Crew Coordination Objective (see Appendix D for an example case study). Aircrews were provided the same case studies but without the discussion points. In developing the case studies, selected accident cases involving crew error were retrieved from ASMIS and synopses created for each case. In addition, Broken Wing Awards were reviewed and synopses were developed for selected cases providing positive examples of crew coordination.

Videotape. Selected cases from ASMIS supported by videotape from the USASC audio-visual library or other aircrew coordination courses were extracted and incorporated into a videotape used by the trainer or unit instructor to visually highlight a particular BQ or Crew Coordination Objective. To facilitate presentation, the video segments were organized in the same order as they appeared in the classroom instruction. The project staff noted that few videotaped Army accidents are included in the USASC audiovisual library to support this very effective teaching technique.

Practical exercises. Practical exercises were developed to support the instruction on premission planning and rehearsal, stress, hazardous thought patterns, and communications (see Appendix F for an example of a practical exercise).

Background reading file. To provide additional information on crew coordination principles and their application, a background reading file was developed. This file includes articles that expand on topics to which only limited classroom discussion time is allocated.

Lesson plan. To assimilate the elements of the Aircrew Coordination Student Course into a cohesive entity, a lesson plan was developed and integrated into the Candidate Aircrew Coordination Exportable Training Package Instructor Guide (Pawlik et al., 1992a). The lesson plan contains the information required by instructor personnel to teach the Aircrew Coordination Student

Course. Data are provided in the margin of the lesson outline to assist the trainer or unit instructor in the use of viewgraphs and in time management. (See Figure 7 for examples of marginal data.) Notes are embedded in the lesson plan to alert instructors when to introduce case studies, video vignettes, and practical exercises.

Development of the Simulator or Flight Training Phase

The USAAVNC Working Group determined that a hands-on phase was essential to the Student Course to reinforce the crew coordination principles taught during the academic phase. Initially, only an evaluation mission was included in the Student Course; however, a second mission was added early in the Crew Coordination II course development effort. Thus, the initial mission would be a training and practice mission and the second mission would allow the crew to operate "solo" prior to their evaluation.

As part of the Crew Coordination II effort to develop the candidate performance measurement methodology, a pretraining (baseline) mission and an evaluation (post-training) mission had been planned. The USAAVNC Working Group decided to use all four missions during the Aircrew Coordination Student Course. Aircrews, therefore, would participate in a baseline mission, two training missions, and an evaluation mission (see Table 8). The Crawl-Walk-Run concept directed by the USAAVNC Working Group was fully implemented.

05+00/S-VG 39

Academic instruction on crew coordination principles, which covers the in-depth definitions, discussion, performance criteria, and illustrations of the 13 Crew Coordination Basic Qualities organized under their respective Crew Coordination Objective.

S-VG 14 (3)

Note: Show Crew Coordination in Army Aviation graphic. Emphasize that the remainder of the course is organized by Basic Qualities categorized under the appropriate Crew Coordination Objective. Encourage participation by asking class to relate specific Basic Qualities to the appropriate Crew Coordination Objective. Review structure prior to discussing the Basic Qualities. (S-VG 36/37)

Figure 7. Extract from lesson plan marginal data.

Development of the Aircrew Coordination Instructor Course (Pawlik et al., 1992a)

In the following paragraphs, we will describe the Instructor Course and discuss the development of its four phases: Methods of Instruction (MOI), the Student Course, Crew Coordination Evaluation, and Scenario Familiarization. The Instructor Course structure is shown in Figure 6.

General

With the finalization of the Aircrew Coordination Student Course design, the requirements of the Aircrew Coordination Instructor Course were determined. Because the purpose of the Aircrew Coordination Instructor Course was to train unit instructors to present the Aircrew Coordination Student Course, a novel approach to training was taken whereby the Instructor Course was wrapped around the Student Course. To provide the unit instructors with the information needed to teach the Student Course, the features of the course were first explained and then MOI refresher training was provided up front. Following the MOI refresher training, the academic phase of the Aircrew Coordination Student Course was presented so that the unit instructors could observe and participate as students. Having learned the crew coordination principles taught in the Student Course academic phase, the instructors were now ready for instruction on the use of the crew coordination evaluation tools associated with the training. Practical exercises were developed to allow the instructors to practice the use of the evaluation instruments to ensure achievement of reliable evaluations among unit instructors. Reliable evaluation is a crucial element in determining the success of crew coordination training.

Lastly, to familiarize unit instructors with the types of scenarios flown in the Aircrew Coordination Student Course, a block of instruction on "Scenario Familiarization" was included in the Aircrew Coordination Instructor Course.

Development of the Methods of Instruction Block

The MOI block emphasized the unique features of the Aircrew Coordination Student Course and the associated training materials. The Instructor Guide, Reference Book, and appendices are reviewed in detail. The lesson plan, marginal data, and notes are discussed. Use of small groups in conducting practical exercises and accident analyses is covered. Because the IPs, who are the course managers, evaluators, and primary instructors, had all previously attended MOI courses, only a review of teaching principles was provided.

Development of the Aircrew Coordination Student Course Block

Only the academic phase of instruction from the previously developed Student Course was presented during this phase of the

Aircrew Coordination Instructor Course. Unit instructors, under the supervision of the project staff, subsequently taught the academic phase, as well as the simulator or aircraft flight training phase, to unit aircrews.

Development of the Evaluation Procedures Block

This instruction emphasized the use of practical exercises designed to produce consistent, objective, criterion-referenced BQ ratings. Audiotape and scripting of actual or simulated situations were used to allow the unit instructors to practice evaluating aircrew performance. To provide a context within which to evaluate unit aircrews and exercise the unit METL, guidelines for effective scenario construction were also provided.

Development of the Scenario Familiarization Block

The scenario familiarization block was developed to provide unit instructors with an overview of the type of scenarios that can be used to evaluate aircrews during baseline and post-training evaluation missions. While in the simulator or aircraft, the salient features of the evaluation scenarios are described in terms of their affect on crew coordination activities. For example, "Upon the crew's arrival at Release Point 1, the time is noted, a radio call is made by pilot-not-flying (P), instructions are received by the P from the pathfinders, instructions are compared by the pilot flying (P*) and the P with the air mission briefing guidance, and the crew either lands or proceeds to the alternate landing zone." Evaluation methods and materials learned in the classroom were integrated into the scenario familiarization mission to demonstrate to the unit instructors how to conduct an aircrew evaluation.

Development of the Appendices and Reference Book (Pawlik et al., 1992a)

The appendices and the Reference Book are the other major elements of the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a). In the following paragraphs, we will cover their purpose, description, development, and use.

Purpose of the Appendices and Reference Book

The appendices and Reference Book were developed to provide detailed supporting data and in-depth background information to more fully develop the crew coordination subjects taught in either the Instructor or Student courses. The Reference Book also serves as the placeholder for the Student Handout and completed practical exercises.

Appendices A-H

The contents of Appendices A-H are summarized in Table 11. Appendices A - G contain information for use by the trainers and unit instructors. Information for use by both the instructors and the students is in Appendix H, the Reference Book, which is discussed separately. For example, evaluation procedures are taught only to the unit instructors; therefore, they are in an appendix; in this case, Appendix F. Background crew coordination articles, however, are located in the Reference Book.

Table 11

Candidate Aircrew Coordination Exportable Training Package
(Pawlik et al., 1992a) Appendices

Appendix	Contents
A. FLIGHTFAX Articles	Placeholder for FLIGHTFAX articles published by USASC.
B. Case Study Discussion Guide	Contains the guidance and discussion points for analyzing the 46 written case studies in the appendix.
C. Aircrew Coordination Training Grade Slips	Provides examples of the grade slips used by evaluators in the Student Course.
D. Aircrew Coordination Training Evaluation Guide	Details the evaluation procedures taught to unit instructors during the Instructor Course.
E. Aircrew Coordination Workshop Rating Exercises	Contains the practical exercises used in the Instructor Course to obtain reliable evaluations.
F. Evaluation Procedures	Lists the duties and responsibilities of crew coordination evaluators.
G. Scenario Guidance	Provides practical guidelines for scenario development; shows examples of operations orders/air mission briefings.
H. Reference Book	Published separately. Contains items of joint instructor and student use.

Appendices A - G were designed to serve several important functions. First, they contain detailed information which would otherwise greatly expand the training lesson plans. Secondly, they preclude having to rewrite the lesson plans each time the supporting information is changed; i.e., only the appropriate appendix need be updated. In addition, they provide a placeholder for current items of information until the courses are formally revised; e.g., FLIGHTFAX articles on recent crew coordination error accidents to be used for updating case studies. The design of the appendices proved to be effective during the validation testbed.

Reference Book

The tabs composing the Reference Book are summarized in Table 12. The Reference Book was published in its own volume due to its large size and because it served a dual purpose; i.e., it provided a source of supporting information common to both the Instructor and the Student courses. The functional design objectives for the Reference Book are the same as those for Appendices A - G. As with the appendices, the design was proven effective during the validation testbed.

Summary of Validation Testbed Lessons Learned

As depicted by Figure 8, the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) underwent several draft versions prior to its use in the validation testbed. The validation testbed was conducted at Fort Campbell, KY, during the period 3 August to 2 September 1992. The following testbed activities were accomplished.

- 3 - 10 August: Aircrew Coordination Instructor Course. Course taught by the project staff for the four IPs and four UTs composing the two testbed instructional teams.

- 11 - 14 August: Pretraining evaluation missions (baseline evaluation mission). Sixteen participating aircrews were evaluated by the four testbed IPs. UTs were tasked with developing training mission scenarios during this period. Instructional teams begin rehearsing in preparation for the Student Course.

- 17 - 19 August: Classroom instruction phase of the Aircrew Coordination Student Course. Phase taught concurrently by the two testbed instructional teams to two sections, each having eight crews. Project staff members were on-site to monitor and assist in the training as part of the instructor certification process.

- 20 - 25 August: Conduct of the two training missions (crawl and walk missions). IPs and UTs taught and evaluated the aircrews during the missions; evaluation procedures were fine-tuned.

Table 12

Reference Book Tabs

Tab	Contents
A. Planning and Rehearsal Practical Exercise Handout	Contains the practical exercise used to prioritize premission planning activities.
B. Crew Coordination Errors: Definitions and Examples	Provides examples of Army aviation accidents organized by crew coordination error.
C. Selected Accidents by ATM Tasks	Provides examples of Army aviation accidents organized by the ATM task being performed at the onset of the emergency.
D. Hazardous Thought Pattern (HTP) Exercises	Contains the forced-choice practical exercises used to develop an HTP profile.
E. Stress Management	Provides articles and practical exercises dealing with stress.
F. Aircrew Coordination Case Studies	Contains the same case studies as Appendix B but without the discussion points.
G. Simulator and Flight Mission Materials	Depicts the items of information provided to the student to plan the training and evaluation missions.
H. Background Reading File	Contains the in-depth crew coordination articles assigned by the instructor as homework.

- 26 - 31 August: Post-training evaluation missions (Run mission). Evaluations conducted by the four IPs. This phase completed the training activities of the validation testbed.

- 1 - 2 September: Debriefing of the testbed participants to obtain input for developing the lessons learned from the aircrew coordination exportable training program validation testbed.

Subsequent to the validation testbed, the lessons learned were used to update aircrew coordination training methods and materials, the result being the Final Aircrew Coordination

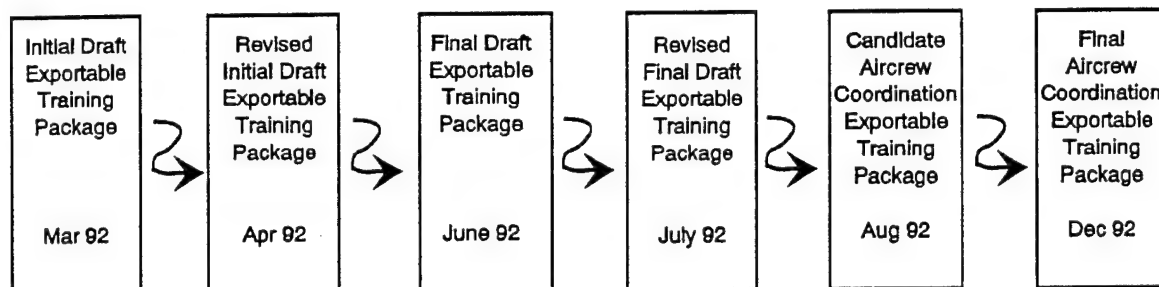


Figure 8. Evolution of the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b).

Exportable Training Package (Pawlik et al., 1992b). Effectiveness of the training package is discussed by Simon and Grubb (1993). The following paragraphs cover the lessons learned in the areas of training development, instructor selection and qualification, planning for training, and training activities.

Training Development

- A structured approach to training aircrew coordination is necessary.

In researching existing crew coordination courses, it was noted that most subjects (Judgment, Decision Making, Situation Awareness, etc.) were universal; however, order of their presentation was not. Most were presented randomly. The Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) utilized the Crew Coordination Model as the framework for pertinent subjects that supported either the Crew Coordination Objectives or the on-going crew mission responsibilities. As such, crew coordination subjects are presented in a logical flow as they would be used in the cockpit.

- Training in aircrew coordination techniques is the cornerstone of effective resource management.

The CRM model (Figure 9) used in developing the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a), considers the systems approach. Both external and internal resources are brought under the integrating skills of the cockpit crew. If aircrew coordination techniques are not required, then the model also describes the single-pilot aircraft.

- Training in aircrew coordination must be culturally correct and relevant.

Guidance furnished by the USAAVNC Working Group recognized these two factors. Airline and other services' crew coordination training was valuable because it was culturally correct and

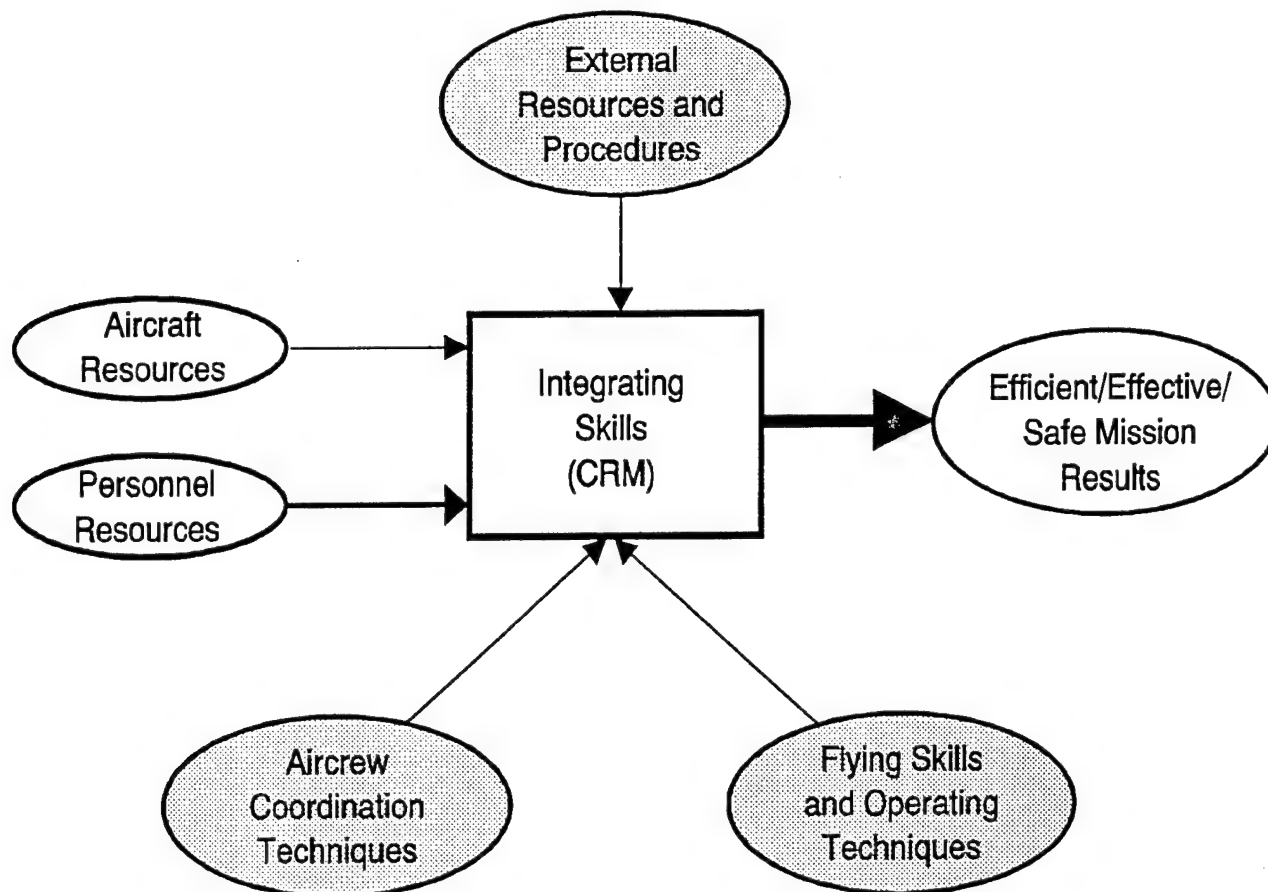


Figure 9. A model of cockpit resource management.

relevant to their specific application. However, such training did not satisfy Army requirements because of differences in operating environments. Tailoring crew coordination training to the unique Army environment, using Army doctrine, and including Army crew coordination successes and failures were a major contributor to its successful application.

- Instruction on crew coordination principles must be reinforced by hands-on training with immediate feedback.

The success of the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) was due in large part to the hands-on simulator training phase.

Immediate feedback was furnished through the use of videotaping. Both the evaluators and the aircrews commented that the videotapes were very instructive.

- A minimum of four simulator/aircraft missions are required to initially instill crew coordination principles.

Two training missions were originally planned for the Aircrew Coordination Student Course. The pretraining and post-training missions were integral to the concurrently-developed aircrew coordination exportable evaluation program. USAAVNC Working Group guidance was to integrate all four missions in the aircrew coordination exportable training program should the validation testbed results so indicate. Comments from the validation testbed participants confirmed that all four missions were required to provide a baseline evaluation mission and to implement the crawl-walk-run approach to training.

- Crew coordination training must be tailored to a specific weapons platform.

Although crew coordination principles can be generalized to virtually any crewed system, the hands-on application cannot. Scenarios must be developed that will exercise the unit's METL, and evaluation procedures must be modified to consider the platform and all crewmembers involved.

- Current simulators do not provide a full means for training the entire crew.

Aircrew coordination training is for all crewmembers. In this respect, it was noted that the simulators used in the validation testbed (UH-60) did not provide seating for the entire crew. With the evaluator and IO on board, nonrated crewmembers could not be accommodated. Simulators are not available for certain aircraft; e.g., OH-58D. Simulators must therefore be supplemented by other training approaches, such as use of aircraft, to fully train and evaluate crew coordination.

- Scenario development training must be provided to instructors.

Aviation organizations generally use the "canned" scenarios developed by the installation simulator facility staff. Although scenario familiarization instruction was provided to the unit instructors during the validation testbed Instructor Course, it was insufficient to give them the depth of knowledge required to construct viable scenarios testing the unit's METL. Prior to the validation testbed scenario-driven training, the simulators were primarily used for instrument work with tactical training accomplished in the aircraft. Aircrews were uniform in their comments that the scenarios used in the pre- and post-training evaluation rides were challenging and provided the type of training they needed during their regular simulator periods. The scenario development training shortcoming was corrected in the final Instructor Course.

Instructor Selection and Qualification

- Select the most experienced IPs to manage and conduct the unit crew coordination training program.

The USAAVNC Working Group directed that the crew coordination training program be accomplished by unit instructor pilots; however, there were insufficient IPs available at Fort Campbell to support the validation testbed. For this reason, the project utilized UTs to assist in all phases of the training except for formal evaluations (pre- and post-training evaluation missions). The IPs, all promotable W2s, had a wealth of experience with which to illustrate the teaching points. The UTs lacked such experience; however, the balancing of the two instructional teams (composed of one IP course director, one IP evaluator, and two UTs each) compensated for this shortcoming and demonstrated the UTs' ability to effectively participate in team teaching the crew coordination program.

- Unit instructors must teach a minimum of one Student Course under trainer supervision prior to certification.

The two instructor groups used during the validation testbed were monitored by the project staff, who provided assistance and answered questions, as necessary. They explained training nuances and corrected departures from accepted practice. Although assistance to the instructional teams was minimal, it is our distinct impression that the lack of such assistance could have negatively affected the training program. With assistance, it was demonstrated that the unit instructors could conduct follow-on courses on their own.

- Unit instructors must attend the entire Student Course and be allowed to practice evaluating students.

The validation testbed Instructor Course for the unit instructors did not include the four simulator missions built in to the Student Course; instead, the instructors received 2 hours of scenario familiarization prior to evaluating students. As such, the unit instructors could not practice the crew coordination principles learned in the classroom. In addition, they received no practice in grading actual student crew coordination performance before conducting evaluations. As a result, inadvertent juxtapositioning of the crawl and walk training missions occurred. The USAAVNC Working Group directed that this situation be corrected in the final Instructor Course by having the instructors attend both the classroom instruction phase and the simulator or flight training and evaluation phase of the final Student Course, as well as participating in a subsequent practice evaluation mission.

Planning and Training

- Plan for limited attendance in each aircrew coordination class and use the crew as the work unit.

Crew coordination training was noted to be strongly influenced by the interpersonal relationships developed among the training aircrews. It was demonstrated that a class size of up to

10 for the Instructor Course and 16 crewmembers for the Student Course was effective. In like manner, assigning at least two crews per group during the practical exercises was also found to be effective.

- Provide adequate time for instructor preparation.

Due to compressed schedules driven by operational requirements, the validation testbed unit instructors had only one week to prepare to conduct the Student Course. During this same time frame, the IPs also conducted the pretraining evaluation missions. This necessitated assigning the scenario development to the team UTs. The project staff recommends that one month be allowed after Instructor Course completion before beginning the Student Course. This one month period was estimated by allowing two hours preparation for each hours instruction, two weeks to develop scenarios, and one week for pretraining evaluations.

- Premission planning is critical to mission success.

Crews that planned, rehearsed, and communicated performed better than those who did not. Mission planning time, therefore, must be used judiciously. This was achieved by having the briefing officer role-play the Operations Officer and by allowing the aircrews to lay out their route before the detailed briefing. During the pretraining mission, several crews did not finish their planning during the time allotted (1.5 hours). During the post-training mission, crews had sufficient planning and rehearsal time because they had effectively learned the techniques taught in the course. Evaluators commented that those crews who planned and rehearsed were unshakable in their focus on the mission objectives despite diversions such as threat and malfunctions.

- Evaluators should not perform evaluator and IO duties concurrently.

Providing an evaluator and an IO in the UH-60 simulator during evaluations was found to be an effective practice. However, this arrangement precludes participation by a nonrated crewmember. Due to the subtleties of interpersonal interactions and nonverbal communication, attempting to operate the simulator while trying to observe the aircrew would greatly hinder the evaluator from accurately determining the crew's coordinating ability.

- The effect of battle-rostering on crew coordination training is unknown.

Battle-rostering may be an effective countermeasure against crew coordination errors while the Army initially trains its aviation crewmembers in aircrew coordination. However, without the standardization provided by aircrew coordination training,

battle-rostering may actually have a negative effect on crew safety; i.e., complacency and overconfidence may develop among crewmembers. In the near-term, whether battle-rostering provides a nurturing environment within which to practice crew coordination principles, or an environment that fosters complacency, remains to be investigated. However, its value in providing a shared experience for the paired crewmembers participating in the pretraining and first training rides is unquestionable. Whether such pairing should continue for the subsequent two rides is debatable.

- Nonrelief of students from unit duties inhibits training effectiveness.

During the validation testbed, students were engaged in night flying and, in one instance, an Emergency Deployment Readiness Exercise (EDRE), which effectively removed one-half of the students from class participation. After combining the remaining halves of each of the two training sections, word was received that the EDRE had been cancelled and the students were returning. On many occasions, students were unable to concentrate in class after being awake most of the night accomplishing unit requirements. Although this is not hazardous during simulator training, it could pose a serious safety problem during training in the aircraft.

Finalization of the Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b)

This section comprises three main topics. The first topic covers the testbed validation course improvements and their incorporation into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). The second topic covers the overall organization of the final package, a detailed breakdown of each of its components, and instructions for the use of the three training guides. The third topic covers the structure of the final aircrew coordination courses.

Differences Between the Validation (Pawlik et al., 1992a) and Final (Pawlik et al., 1992b) Aircrew Coordination Exportable Training Packages

Project staff observations and testbed subject comments resulted in a number of insights that led to changes in the training courses; thus, the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) differs markedly from the Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a). Differences between the two packages in the areas of training materials, training aids, practical exercises, simulator or flight training, methods of instruction, evaluation, and scheduling are discussed below.

One major difference not reflected elsewhere because it was a planned change is the provisioning of reproducibles to support

the final training package. The validation testbed training package (Pawlik et al., 1992a) was produced in a limited quantity; all parts were furnished and the trainers did not need to reproduce any materials. The final training package (Pawlik et al., 1992b) will be mass produced and reproduction of several items, such as the read-aheads, student handout, practical exercises, videotapes, and viewgraphs will be required. The reproducible masters needed for this purpose were developed and provided with the final training package (Pawlik et al., 1992b).

A second major difference between the two packages involves course titles. The candidate exportable training course for instructor personnel was named the Aircrew Coordination Trainer Course. In the final package (Pawlik et al., 1992b), that course is renamed the Aircrew Coordination Instructor Course. This change was necessary to allow for the USAAVNC establishment of an Aircrew Coordination Trainer Course to train the instructors who will be certified to conduct the Aircrew Coordination Instructor Course when the crew coordination program is fielded. Unit instructors trained during the Aircrew Coordination Instructor Course will subsequently teach the Aircrew Coordination Student Course to unit aircrews. Here, again, a title change was necessary. In the Candidate Exportable Training Package (Pawlik et al., 1992a), the Student Course was so named. In the final exportable training package (Pawlik et al., 1992b), the course was renamed the Aircrew Coordination Course. In line with the remainder of the Trainer and Instructor Courses, the title of Student Course was readopted to better describe the courses' purpose.

Training Materials

Table 13 summarizes the enhancements to the validation testbed training materials incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

- Packaged the Final Aircrew Coordination Exportable Training Package into three Volumes.

The Candidate Aircrew Coordination Exportable Training Package (Pawlik et al., 1992a) used during the validation testbed comprised two volumes: The Instructor Guide and the Reference Book. The final package comprises three "Guides": Trainer, Instructor, and Student. Each of the three guides is designed for a specific purpose. All three guides are used by the training cadre to conduct the Instructor Course; the Instructor and Student Guides are used by the unit instructors to conduct the Aircrew Coordination Student Course; and the Student Guide is used by training aircrews. Directions are provided to ensure each guide is used for its intended purpose.

- Added an Instructor Read-ahead (see Appendix G) to the Trainer Guide.

Table 13

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) Training Materials

Enhancement	How incorporated
Packaged into three volumes	Final package contains the Trainer Guide, Instructor Guide, and Student Guide.
Instructor Read-ahead added	Instructor Read-ahead added to Appendix A of the Trainer Guide.
Two Student Read-aheads added	Student Read-aheads added to Appendix A of the Instructor Guide.
Background Reading abstracts provided	Abstracts added to Appendix G of the Student Guide.
Background Reading File reduced	Articles indicated to be of little interest not included.
Learning Objectives reformatted	Reformatted text and realigned training materials in all three guides.
MOI principles added	Added MOI principles to Instructor Course.
Student Handout expanded	Added instructor talking points to Student Handout.
Cross-Walk Chart added	Added Cross-Walk Chart to both the Student and Instructor Courses.
After-Action Review Checklist added	Added After-Action Review Checklist to Student Course.

To inform the unit instructors of the purpose of the Instructor Course and the initial reading assignments, a read-ahead was developed for the trainers to issue one week prior to the Instructor Course start date. (Note: Substitute "Instructor" for "Trainer.")

- Added two Student Read-aheads (see Appendix H) to the Instructor Guide.

The student read-aheads were developed for the same purpose as the instructor read-ahead. Read-aheads 1 and 2 are issued immediately prior and subsequent to the pretraining mission, respectively.

- Provided abstracts (see Appendix I) for the background reading articles in the Student Guide.

Abstracts were developed to assist the instructors and students in selecting background reading articles for study or reference.

- Reduced the number of articles in the background reading file.

Several articles were found to be of limited or no interest to testbed participants and were deleted from the background reading file.

- Reformatted the learning objectives of the Instructor and Student Courses.

Learning objectives for both final courses were revised to conform with TRADOC formatting requirements. Supporting subjects were realigned to match the new learning objective arrangement.

- Added MOI principles to the Instructor Course.

Because IPs attending the Instructor Course are MOI qualified, a teach-back procedure was not considered necessary. An MOI review was added to the final course to refresh unit instructors on teaching principles.

- Expanded the Student Handout to include talking points.

Validation testbed students occasionally lost their place in the Student Handout where instructor talking points were not provided. The main idea of each talking point is now included in the handout.

- Integrated the Cross-Walk Chart (see Figure 3) into both courses.

The USAAVNC Working Group originally believed that the chart was too complex and might confuse the students. Testbed instructors and students both recommended its issue to better depict the interrelationship between the Crew Coordination Objectives, Crew Coordination Basic Qualities, and Crew Coordination Elements (Simon, 1993).

- Developed and added an After-action Review Checklist to the Student Course (see Appendix J).

The after-action review concept was taught during the validation testbed; however, no checklist had been developed for student use. The checklist was developed for the final Student Course and recommended for inclusion in all ATMs.

Training Aids

The Crew Coordination in Army Aviation Graphic and the Crew Coordination Model were produced in wall-chart size for classroom use.

Practical Exercises

Table 14 summarizes the enhancements to the validation testbed practical exercises incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

- Hazardous Thought Pattern (HTP) practical exercise forced-choice protocol downplayed.

Students objected to the choices available on the HTP practical exercise. Text was provided to explain the reason for the forced-choice protocol and to encourage the students to complete the exercise.

- Stress Life Events practical exercise honesty factor emphasized.

Provided text to point out that unless the students answered life events honestly, the exercise was meaningless. To encourage honesty, the exercise is done as homework with only its statistical meaning discussed in class.

Table 14

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) Practical Exercises

Enhancement	How incorporated
Hazardous Thought Pattern practical exercise forced-choice protocol downplayed	Provided text to encourage students to complete the exercise.
Stress Life Events practical exercise honesty factor emphasized	Provided text to point out that the practical exercise was meaningless if not honestly answered.
Planning practical exercise factors consolidated	The 35 planning factors were reduced to 10 task-related groups.
Communications practical exercise expanded	A tactical example was added to the practical exercise.

- Planning practical exercise factors consolidated.

Consolidated the 35 factors in the Planning practical exercise into 10 task-related groupings. Students were unable to rank order the 35 factors in the 10 minutes allotted; reduction to 10 items should alleviate the problem.

- Communications practical exercise expanded.

The original practical exercise had only one associated task: to describe a group of assorted interlocking geometric figures. To provide training relevancy, students will now be required to describe a tactical area; e.g., helicopter landing zone.

Simulator or Flight Training

Table 15 summarizes the enhancements to the validation testbed simulator or flight training incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

- Baseline and evaluation missions incorporated into the Student Course.

Validation testbed results supported the requirement that the pretraining and post-training evaluation missions be integral to the Student Course to effectively implement the Crawl-Walk-Run training philosophy.

Table 15

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik, et al. 1992b) Simulator/Flight Training

Enhancement	How incorporated
Baseline and evaluation missions incorporated into Student Course	Added the baseline and evaluation missions to the simulator or flight training and evaluation phase of the Student Course.
Learning versus evaluative aspects of training missions emphasized	Text provided to emphasize the learning aspects of the training missions.
Practice evaluation mission added to Instructor Course	Mission added to the Scenario Familiarization and Evaluation Phase.

- Learning versus the evaluative aspects of the training missions emphasized.

Problem arose whereby unit instructors were not providing instruction during the training rides but were performing, in effect, as evaluators. This situation was corrected and text added in the lesson plan to preclude recurrence.

- Practice evaluation mission added to the Instructor Course.

Unit instructors received evaluation training during the evaluation workshop; however, no actual practice was provided in grading and rating crew coordination prior to evaluating student aircrews.

Methods of Instruction

Table 16 summarizes the enhancements to the validation testbed MOI incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

- Team teaching is emphasized by recommending the use of both IPs and UTs.

Included text in the "About the Student Course" section of the Instructor Guide that outlines instructor team composition and use.

- Homework assignments are reviewed daily.

Noted in the Instructor Guide's Aircrew Coordination Student Course lesson plan that outside assignments be reviewed prior to each day's first hour of instruction.

- Crew coordination definition emphasized.

Included text in the Student Course to explain that crew coordination is not learning how to operate an aircraft with a particular crewmember; it is a set of standardized operating procedures and techniques to be used in any situation.

- CH-54 accident crew coordination error stressed.

Students did not discern the crew coordination error aspects of the accident. When the cross-monitoring basic quality was addressed, crew error aspects became evident.

- Rating factors and behavioral anchors use defined.

Rating factors are used to describe performance criteria in the classroom; behavioral anchors are used for evaluation.

Table 16

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) MOI

Enhancement	How incorporated
Team teaching emphasized	Included in course description of the Student Course.
Homework assignments reviewed daily	Included note in Student Course lesson plan to review homework prior to first class of the day.
Crew coordination and battle-rostering disassociated	Explained confusion caused by concurrent introduction.
Crew coordination definition emphasized	Defined to distinguish from battle-rostering.
CH-54 accident crew coordination error stressed	Related accident to crew coordination failure.
Rating factors and behavioral anchors use defined	Rating factors in classroom, behavioral anchors for evaluation.
Superior rating factors emphasized	Acceptable rating with training, superior with experience.
Operations officer role-played	Briefing officer role-playing conserves planning time.

- Superior rating emphasized.

More emphasis has been placed on describing "Superior" rating factors. Crews should attain "Acceptable" levels of performance after training and "Superior" levels with practice.

- Operations officer role-played.

Briefing officer now acts as Operations Officer during the premission planning phase. Planning time is thereby maximized.

Evaluation

Table 17 summarizes the enhancements to the validation testbed evaluation procedures incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

Table 17

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) Evaluation Procedures

Enhancement	How incorporated
Hands-on scenario development activities provided	Instruction on scenario development added to Instructor Course.
Crew coordination evaluation techniques expanded	Provided oral exam questions for evaluation missions.
BQ citations delimited	Removed restriction from citing only two BQs for degraded task performance.
BQ 3 retitled	Changed descriptor from "selection" to "application" of appropriate decision making techniques.
Videotape debriefings redefined	Additional guidance provided to instructors on use of videotapes for aircrew debriefings.

- Hands-on scenario development activities have been provided.

Instruction in the Instructor Course covering the development of IO scripts and evaluation mission segment worksheets has been enhanced.

- Crew coordination evaluation techniques have been expanded.

"Oral Exam" questions have been added to the evaluation techniques as an option during the evaluation process.

- BQ citation restriction has been removed.

Original instructions were to cite not more than two BQs for any task downgraded due to crew coordination techniques. Evaluators may now cite as many BQs as are appropriate to the task.

- BQ 3 has been retitled.

Evaluators had difficulty with the title, "Selection of appropriate decision making techniques" (Simon, 1993). BQ was retitled "Application of appropriate decision making techniques."

- Videotape debriefings were redefined.

Additional guidance was provided to the evaluators on the use of videotapes to debrief the aircrews. Use of the tapes is mandatory and not a choice to be made by the debriefed aircrew.

Scheduling

Table 18 summarizes the enhancements to the validation testbed scheduling activities incorporated into the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Each of the enhancements is discussed below.

- Full-day crew coordination training is recommended.

Course descriptions allow either three 6 hour sessions or six three-hour sessions. Full-day training (6 hrs) is recommended for each course to enable expeditious completion and subject retention.

- Excused duty status of students is recommended.

If students are not placed in excused duty status, unit requirements may cause training disruptions and degraded performance; e.g., night flying.

Table 18

Enhancements to the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) Scheduling Activities

Enhancement	How incorporated
Full-day training recommended	Both course descriptions provide several options for conduct. Full-day training is recommended.
Excused duty status recommended	Both course descriptions note the problems associated with student attending instruction in unit duty status.
Crew coordination training included on unit training schedule	Both course descriptions recommend that crew coordination training be placed on the unit training schedule to ensure attendance.
Crew coordination class sizes limited	Class size limitations stated in both course descriptions.

- Crew coordination training must be included on the unit training schedule.

If the training is not scheduled, attendance will suffer. Supervisors must know when their subordinates will be unavailable and plan accordingly.

- Crew coordination class sizes must be limited.

Course descriptions limit attendance to no more than 16 rated and nonrated crewmembers per Student Course, and 8 to 10 in the Instructor Course. Exceeding these limits will impact on the interpersonal relationships necessary to accomplish the training objectives.

Description of the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b)

This section provides an overview of the Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Details of the training package are in Appendix I which describes each component and outlines the procedures covering the use of the three training guides by USAAVNC trainers, unit instructors, and students. For reasons previously stated, when reading Appendix I, substitute "Aircrew Coordination Instructor Course" for "Aircrew Coordination Trainer Course" and "Aircrew Coordination Student Course" for "Aircrew Coordination Course", where mentioned.

Overview

The Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) comprises three guides: Trainer, Instructor, and Student. They are interdependent documents and are used in specific combinations to conduct a particular course. Trainers use all three guides to conduct the Instructor Course. Unit instructors use the Instructor Guide and Student Guide to receive and subsequently conduct the Aircrew Coordination Student Course. Aircrews use only the Student Guide.

Trainer Guide

The Trainer Guide contains the lesson plan for the Instructor Course (Sections 1 through 5) and an appendix for the Instructor Read-ahead.

Instructor Guide

The Instructor Guide contains the same five sections contained in the Trainer Guide except that Sections 1, 2, 4, and 5 are in skeletal format for note-taking. Section 3, the Aircrew Coordination Student Course, which is integral to the Instructor Course, is provided in its entirety for use by unit instructors to subsequently train unit aircrews. Instructions and appendices

required solely by the trainers and unit instructors are also contained in the Instructor Guide.

Student Guide

The Student Guide contains the Aircrew Coordination Student Course lesson plan in skeletal format for note-taking. Those appendices common to trainers, unit instructors, and students are also located in this guide.

Reproducibles

A separate package of reproducibles is provided with each set of Guides. Reproducibles are items precluded from reuse due to note-taking (Student Handout, practical exercises), items required in specific numbers to support training (Read-aheads), or items requiring reproduction in limited numbers due to cost or quantity (videotapes, viewgraphs).

Structure of the Final Aircrew Coordination Student Course and Aircrew Coordination Instructor Course

The Final Aircrew Coordination Student Course structure is shown at Figure 10. The course structure and recommended training schedule for the Instructor Course is at Figure 11 and Table 19, respectively.

Recommendations for Final Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) Use and Improvement

This section covers recommendations for the use and improvement of the final exportable training package (Pawlik et al., 1992b) based on project staff observations, testbed participants' comments, and USAAVNC Working Group suggestions.

Recommendations for Use

Based on the experiences and lessons learned during the Crew Coordination I and II testbeds, several recommendations are made concerning the fielding of the Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). These recommendations pertain to the Trainer Course, the Instructor Course, and the Student Course.

USAAVNC plans to field the Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) using simulation centers located throughout the continental United States, Europe, and Korea, to include the Reserve Component facilities (Eastern and Western Area Training Sites) (D. Leedom, personal communication, February 1993). It is recommended that:

- USAAVNC amend the fielding plan to include a Crew Coordination Trainer Course that will provide for the initial training of key personnel, and that

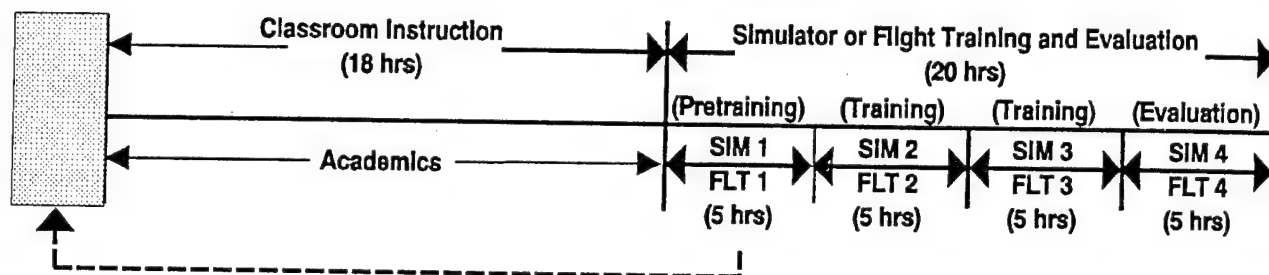


Figure 10. Structure of the Aircrew Coordination Student Course (38 hours).

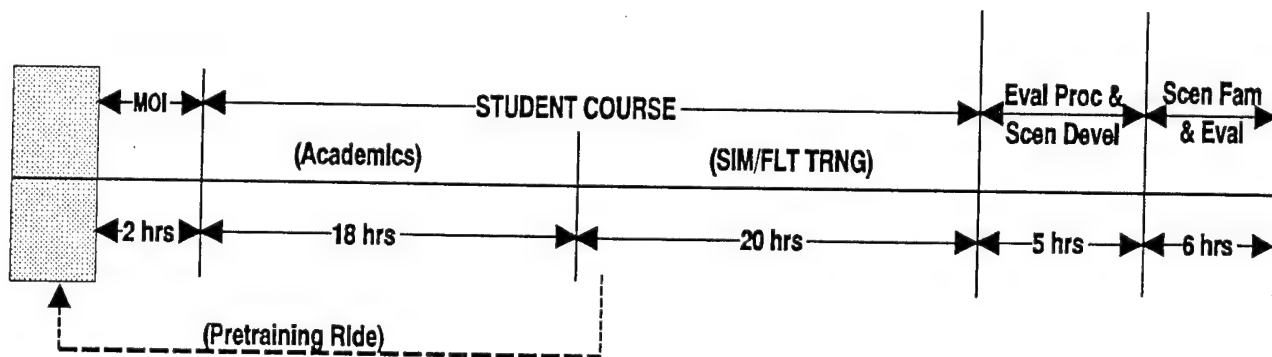


Figure 11. Structure of the Aircrew Coordination Instructor Course (51 hours).

- Selection and certification criteria for attendance at this Trainer Course be developed to ensure that only highly qualified IPs are selected to subsequently train the unit instructors at the various simulation centers.

With respect to the Instructor Course, it is strongly recommended that the time scheduled at each simulation center be extended. The USAAVNC trainers should remain on-site to supervise at least one iteration of the Student Course by the newly-trained unit instructors. This type of supervision was found to be invaluable during the crew coordination validation testbed. While under the direct supervision of the project staff, the unit instructors were able to greatly refine their instructional and evaluative techniques. Furthermore, it is only through this approach that standardization of training and evaluation can be ensured.

The following recommendations concern the Student Course and address command involvement, quality control of training, selection and certification of unit instructors, class size, duty status of attendees, and continuation training.

Table 19

Aircrew Coordination Instructor Course Schedule

(Basis: 8 Unit Instructors/1 Dedicated Simulator or Aircraft)*

Time	Event									
0630 - 0730	Pretraining Ride				①	②	③		Practice Evaluation	
0730 - 0830	MOI									
0830 - 0930	Classroom Instruction	Classroom Instruction	Classroom Instruction	Classroom Instruction						
0930 - 1030				Open						
1030 - 1130				Training Ride 1	Training Ride 2	Evaluation Ride				
1130 - 1300				LUNCH						
1300-1400							Open			
1400 - 1500	Instruction (Cont.)	Classroom Instruction (Cont.)	Classroom Instruction (Cont.)					Evaluation Procedures & Scenario Develop.		
1500 - 1600										
1600 - 1645	Open	Open	Open	Open				Open (Study Time)		
Training Day	1	2	3	4	5	6	7	8	9	10

*Additional unit instructors will extend the training days w/o additional simulators/aircraft

Involvement of Commanders

For the aircrew coordination training program to be successful, commanders at all levels must understand and support the philosophy embodied in the crew approach to training and operations. Junior crewmembers may be reluctant to assert themselves even after crew coordination training unless they know with a degree of certainty that the commander will support them. Also, commanders need to see firsthand the benefits of the crew coordination program in respect to the resources required for its execution.

Quality Control of Crew Coordination Training

Installation standardization personnel should be included in the initial classes for key instructors trained at any installation. They should be responsible for monitoring subsequent training to ensure standardization.

Selection of Unit Instructors

Primary consideration must be given to selecting the most experienced aviation personnel in the organization. The experience of commercial and DoD programs and observations made during Crew Coordination II clearly indicate that the best instructors had a wealth of experience from which to draw to enhance a particular teaching point. Also, senior aviators who view the crew coordination program as important and convey that belief to each crewmember will have a profound affect on the entire unit. It is imperative that crew coordination instructors not be selected solely on the basis of availability.

Certification of Unit Instructors

USAAVNC should establish a means of certifying unit instructors teaching the Aircrew Coordination Student Course. We recommend the procedure followed during Crew Coordination II whereby the candidate instructors completed the initial training and conducted the appropriate course under the supervision of qualified instructors. To ensure the standardization of aircrew coordination training, we strongly recommend that instructors be certified by USAAVNC trainers prior to conducting courses on their own.

Class Sizes

The class sizes stated in the course information sections of both the Aircrew Coordination Student Course and the Aircrew Coordination Instructor Course should be adhered to. Training effectiveness has been validated using the class sizes recommended (Simon, 1993).

Duty Status of Attendees

Where possible, students should be excused from duty for the duration of the applicable course. Due to the amount of training materials and the time recommended for course completion, each student will need to make a concentrated effort to accomplish the course objectives. Unit requirements diverting time from class or study will degrade the individual's ability to learn and subsequently apply the crew coordination principles.

Aircrew Coordination Continuation Training

As has been shown not only in crew coordination training but in other types of training as well, reinforcement is the key to retention. Crew coordination training should not be viewed by the Army as a one-time train-up effort; it is recurrent training. We, therefore, recommend that USAAVNC provide guidance to the field on methods and techniques to develop crew coordination continuation and refresher training. The exportable training program discussed in this report provides a solid foundation for developing these types of courses. Giving additional credence to this approach is that the field exportable crew coordination evaluation program (Grubb, Simon, & Zeller, 1992), which will be used to evaluate crew coordination in the field, is based on the same concepts and principles as the exportable training package (Pawlik et al., 1992b).

Recommendations for Improvement

General

Almost all of the Crew Coordination II testbed participants' recommendations, as well as the USAAVNC Working Group's guidance, were incorporated into the final version of the Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b). Several recommended improvements could not be incorporated into the final version due to resource constraints. Other constraints were of an organizational nature; e.g., doctrinal in that DRC has no control over material published in aviation training circulars. Our recommendations are discussed below.

Attention-Getter Videotape

The video segment used during the course introductions (AH-1F, USASC Case #910205011) is not well documented because the accident report was not available; therefore, no specific crew error could be presented. Several typical crew errors associated with sudden loss of visual references were presented as possible explanations. A more fully documented case having video support should be substituted for the current example.

BQ Illustration Videotape

The vignettes used to illustrate the BQ teaching points are not all Army aviation specific. For example, the vignette used to exemplify team relationships and team climate (BQ 1) is of a commercial aviation accident that occurred at Ketchikan, AK. The vignette used to exemplify prioritizing actions and distributing workload (BQ 4) is an extract from a television reenactment of Eastern Airlines Flight 401. Although these vignettes involve aircraft and situations that do not relate directly to Army aviation, they are professionally produced and adequately portray common crew coordination problems. There are, however, fully documented Army aviation accident cases that could be scripted and recreated in a simulator using Army pilots. These vignettes would provide better illustrations of crew coordination problems; e.g., for BQ 1, USASC Case # 921112011 (C-12F accident in Alaska), and for BQ 4, USASC Case # 870128031 (UH-60 accident at Gieblestadt, FRG). In addition to the accident cases, vignettes could also be constructed from excerpts taken from the Crew Coordination II validation testbed missions. For this purpose, a list of potential Crew Coordination II validation testbed videotapes, with appropriate segments annotated, is provided at Appendix L.

Evaluation Workshop Practical Exercise Videotape

During Crew Coordination II, an audiotape dubbed from the videotapes recorded during Crew Coordination I was used for the evaluation workshop practical exercises to portray instances of good and poor crew coordination. This technique was not very effective. Accordingly, it is recommended that a videotape for the crew coordination evaluation workshop be constructed from excerpts of the Crew Coordination II videotapes identified by the project staff. Using actual Army examples edited to present the crew coordination information visually and auditorially would be more effective than using the auditory sense alone. For this purpose, a list of potential Crew Coordination II validation testbed videotapes, with appropriate segments annotated, is provided at Appendix M.

Consolidated Aircrew Coordination Videotape

We recommend that the attention-getter, BQ illustration, and the crew coordination evaluation workshop (when developed) videotapes be consolidated into one videotape. Fielding a single videotape with the exportable training package reproducibles would represent a resource savings and make the package easier to handle.

Viewgraphs

Additional graphics should be created to support the training. Currently, there is an over-reliance on text for the

classroom viewgraphs. Additional graphics would make the viewgraphs more enjoyable.

ATMs

Modify the ATMs to incorporate the Crew-level After-action Review Checklist (see Appendix J for the checklist) into a task entitled, "Conduct Crew-level After-action Review." The checklist should be incorporated in the same manner as the Crew Mission Briefing Checklist for ATM Task 1000 (Conduct Crew Mission Briefing).

Videotaping of Simulator or Aircraft Missions

Simulator or aircraft assets dedicated to the support of initial aircrew coordination training should be equipped with video recorders capable of filming the entire flight. As verified during Crew Coordination II, one of the keys to successful evaluator debriefings is the videotape, which records exactly what occurred in the cockpit. With videotape, the evaluator does not have to rely on notes or other recall techniques to present a situation and its proper resolution. With videotape, the students themselves are able to discern where they erred and propose their own solutions.

Conclusion

The USAAVNC Aircrew Coordination Exportable Training Package (Pawlik et al., 1992b) evolved over a three-year time period spanning two testbeds. The package, and its integral evaluation system, has been validated in a simulated, tactical environment utilizing Army aviation crewmembers. It is unique in its approach to training, technically sound, and culturally correct. Its real value, however, is that it uses generalizable models that are applicable to any crewed system.

As a result of Army Aviation's sponsorship of ARIARDA's pioneering work in the area of simulator-intensive, scenario-driven, hands-on training and evaluation, the Army now has a crew coordination course that can be tailored to any crewed system. The initial proliferation of this crew coordination training, as well as provisions for continuation and refresher follow-on training, is the challenge that the Army must now resolve.

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Appendix A
ACE Checklist

UH-60 Aircrew Coordination Evaluation (ACE) Checklist

Rev. 4

(To Be Completed By Evaluator Observing the Mission)

I. Flight, Crew, and Equipment Information

1. Date: _____
2. Reporting Time: _____
3. Mission Total Flying Hours: _____
4. Mission Completion Time: _____
5. Mission Total Time: _____ (Subtract item #2 from item #4)
6. Type Equipment: Acft Simulator (circle one)
7. Type Mission: SVC MTF TRNG (circle one)
8. NVG Used: Y or N (circle one) % Illumination Predicted: _____ Estimated Actual: _____
9. Mission Purpose/Description (include a listing of ATM Tasks Performed when appropriate): _____

10. Type Flight Plan: VFR IFR Composite (circle one)

11. Predicted Condition: VMC IMC (circle one)

12. Actual Condition: VMC IMC (circle one)

13. Crew Composition (checkmark for each crewmember present)

PC _____ PI _____ CP _____ CC _____

14. Previous experience of individuals as crewmembers flying together regardless of previous seat position; for example, for a two person crew, one pair would be marked; for a three person crew, three pairs would be marked. (Mark all pairings as appropriate.)

Position Pairing	Estimated # Missions	Estimated # Hours
a. PC - PI	_____	_____
b. PC - CP	_____	_____
c. PC - CC	_____	_____
d. PI - CP	_____	_____
e. PI - CC	_____	_____
f. CP - CC	_____	_____

15. Cross-Indexing Code (Explain to aircrew that responses will not be used to evaluate individual aviators. Results will not become a part of the aviator's record. However, an individual identifier is necessary since most aviators will be completing other forms to support the research project.)

Social Security Number

a. PC _____
b. PI _____
c. CP _____
d. CC _____

16. Evaluator Name: _____

17. Qualification: IP____ SP____ IE____ ME____
(Check One)

II. Crew Communications and Coordination

(Circle the one number on each dimension which best describes the behavior of the crew during the mission.
Consult the "Instructions for Making Ratings on the ACE Checklist Dimensions" before making ratings.)

CREW COORDINATION BEHAVIORS		Very Poor	Poor	Borderline/ Marginal	Fully Acceptable	Good	Very Good	Superior
1.	Thorough pre-flight mission plan developed	1	2	3	4	5	6	7
2.	Statements/directives clear, timely, relevant, complete, and verified	1	2	3	4	5	6	7
3.	Inquiry/questioning practiced	1	2	3	4	5	6	7
4.	Advocacy/assertion practiced	1	2	3	4	5	6	7
5.	Decisions communicated and acknowledged	1	2	3	4	5	6	7
6.	Actions communicated and acknowledged	1	2	3	4	5	6	7
7.	Crew self-critique of decisions and actions	1	2	3	4	5	6	7
8.	Crewmember actions mutually cross monitored	1	2	3	4	5	6	7
9.	Interpersonal relationships/group climate	1	2	3	4	5	6	7
10.	Aircraft, personnel, and mission status reported	1	2	3	4	5	6	7
11.	Distractions avoided or prioritized	1	2	3	4	5	6	7
12.	Workload effectively distributed/redistributed	1	2	3	4	5	6	7
13.	Support information/actions sought from crew	1	2	3	4	5	6	7
14.	Support information/actions offered by crew	1	2	3	4	5	6	7
OVERALL MISSION PERFORMANCE AND WORKLOAD		Very Low						Very High
15.	Overall technical proficiency	1	2	3	4	5	6	7
16.	Overall crew effectiveness	1	2	3	4	5	6	7
17.	Overall workload	1	2	3	4	5	6	7

- III: **Special Circumstances:** This section provides data on non-standard situations or behaviors that may influence crew performance. If abnormal emergency situations arose, rate the overall management of the situation. If conflicts occurred, rate how effectively they were resolved.

		Very Poor	Poor	Borderline/ Marginal	Fully Acceptable	Good	Very Good	Superior
18.	Management of abnormal or emergency situation	1	2	3	4	5	6	7
19.	Conflict resolution	1	2	3	4	5	6	7

20. **Individual Ratings:** In some cases the actions of a particular crewmember may be particularly significant to the outcome of the mission. In cases where this happens, enter the relevant item number from the above items (1-14), check the position of the crewmember rated, and circle the appropriate number on the dimension which reflects that individual's performance.

		Very Poor	Poor	Borderline/ Marginal	Fully Acceptable	Good	Very Good	Superior
_____ Item _____	PC / PI / CP / CC	1	2	3	4	5	6	7
_____ Item _____	PC / PI / CP / CC	1	2	3	4	5	6	7
_____ Item _____	PC / PI / CP / CC	1	2	3	4	5	6	7

- IV. **Comment on any extreme or unusual (especially 1 or 7) ratings on any item in Section II or III.**

Item #

Comments

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- V. **Comments on Extreme or Unusual Conditions or Behaviors:** Describe conditions, conflicts, or unusual individual behaviors which occurred during the mission.

- VI. **Supplementary Information:** Conditions which significantly influenced the flight (include weather, ATC information, pre-existing mechanicals, etc.) Describe below.

- VII. **Post Flight Questions** (Ask the following questions of each crewmember after completion of the flight. Record the responses below.)

1. Were you aware that this specific mission or scenario would be used prior to reporting to the flight line today? Response options are as follows:

0 - No Information about any aspect of the mission or scenario

1 - Slight Familiarity with the mission and/or scenario

2 - Considerable Familiarity with the mission and/or scenario

3 - Detailed Information on the mission and scenario

(Circle one response for each participating crew member, (e.g., PC: 0))

	No Information	Slight Familiarity	Considerable Familiarity	Detailed Information
1. PC:	0	1	2	3
2. PI:	0	1	2	3
3. CP:	0	1	2	3
4. CC:	0	1	2	3

2. To what extent did you experience motion sickness during this simulator session/flight?
(Circle one response for each participating crewmember.)

	None	Scarcely any	Very Little	A little	Some	Quite a bit	A great deal
1. PC:	0	1	2	3	4	5	6
2. PI:	0	1	2	3	4	5	6
3. CP:	0	1	2	3	4	5	6
4. CC:	0	1	2	3	4	5	6

Appendix B

ATM Task 1071

TASK: PERFORM AIRCREW COORDINATION

CONDITION: In a UH-60 helicopter or UH-60FS

STANDARDS:

1. All crewmembers actively participate in the preflight/inflight mission planning.
2. A detailed aircrew briefing is accomplished prior to takeoff.
3. Each crewmember acknowledges his role, responsibilities, and tasks for the entire mission.
4. Two-way communication is established and maintained using standard phraseology and visual signals.
5. Differences of opinion are encouraged and judiciously resolved in an atmosphere of mutual respect.
6. All essential information is shared between crewmembers.
7. All crewmembers participate in the problem solving process.
8. Situational awareness is demonstrated at all times by each crewmember with respect to mission objectives, aircraft position, equipment status, environmental conditions, and personnel capabilities.
9. All crewmembers coordinate task execution to ensure that critical task timing and task sequencing is achieved.
10. All crewmembers participate in the critique process by offering criticism in a constructive, supportive manner.
11. Crewmembers work smoothly as a team committed to safe, mission-oriented flying.

DESCRIPTION: Close and continuous coordination between crewmembers is essential to mission success. Aircrew coordination begins with thorough preflight planning followed by a detailed aircrew briefing. The PC, as the cockpit resource manager, defines each crewmember's role, delegates responsibilities, and assigns tasks covering both routine and emergency situations. The aircrew briefing covers specific responsibilities and duties during the entire mission. Of special significance is the assignment of clearance responsibilities. Clearance responsibility is paramount and is not abandoned in lieu of other tasking(s) without announcement, acknowledgement, and assumption of the clearance sector by another crewmember. The pilot flying, unless under actual

IMC, is always "outside" the cockpit during terrain and aided flight. "Inside" cockpit duties, e.g., instrument monitoring, frequency changes, NAVAID programming, and passenger control, are tasked to the pilot not flying or non-flying crewmember(s). If unable to divide attention between clearing and "inside" cockpit duties, the affected crewmember advises the pilot flying so that workload may be redistributed. Crewmembers discuss expected hazards, e.g., high traffic areas, converging airways and reporting points, wires, descent corridors, and multi-aircraft formations, and plan their observational coverage accordingly. Non-flying crewmember(s) position themselves to best observe the hazard(s). Where feasible, aircraft control is passed to the pilot best able to observe the hazard(s). Hazards observed by crewmembers are described to the pilot flying in terms of type, direction, and distance. Each crewmember clearly understands and acknowledges his role, responsibilities and tasks for the entire mission before the mission begins. Two-way cockpit communication is established using standard phraseology and commonly accepted nonverbal signals. Of special importance is the positive transfer of aircraft controls. Under no circumstances does the pilot not flying assist on, or assume, the controls without positively announcing such action and the purpose therefore. When assumption or assistance is announced, confirmation is made by the pilot flying. Inquiry/questioning is carried on freely between crewmembers; and advocacy/assertion practiced as required without fear of censure. Differences of opinion are encouraged and judiciously resolved; and all crewmembers participate in the problem solving/decision-making effort if the situation allows and time is available. Final decisions are announced by the PC, acknowledged, and collectively implemented in a cooperative fashion. Where time precludes announcing a decision, crewmembers call for a decision review when circumstances allow. Plans/intentions are always verbalized and presented in a timely manner; and information is shared between crewmembers at appropriate decision points. The pilot not flying anticipates requirements for information or tasking and requests direction from the pilot flying. Under no condition does the pilot not flying unilaterally execute an unassigned task without the approval or request of the pilot flying. Checklists are used together with fixed procedural terminology and the proper challenge and response. Each crewmember is aware of the current situation at all times with respect to mission objectives, aircraft position, equipment status, environmental conditions, and the capabilities of fellow crewmembers. Crewmembers are sensitive to the mental and physical states of one another and are not hesitant to advise of personal problems inhibiting effective performance. Stress is managed to maintain a relaxed, business-like atmosphere employing casual conversation and humor to maintain a moderate level of arousal during periods of low workload. All tasks are accomplished in a concerted manner with crewmembers cooperatively readjusting the workload by assuming unassigned tasks. Task transfers are acknowledged by the pilot flying and the transferring crewmembers. Tasks are voluntarily assumed in order to help one another because of perceived task saturation established through observation or error checking. Error checking is routinely accomplished and reported to the responsible crewmember. Errors are specifically described and announced in a concise manner without excessive professional courtesy, e.g., "100' above assigned altitude;" and the two-challenge rule is employed prior to assuming the aircraft controls, if necessary. Top-down/bottom-up constructive critiques are accomplished as required either during or after the mission to ensure all crewmembers are performing or are being trained to accepted standards. Crewmembers exhibit mutual support and are positively motivated by the PC to continuously improve upon past performance.

NIGHT OR NVG CONSIDERATIONS:

1. During night or NVG operations, aircrew coordination is especially critical to successful mission accomplishment. Under such conditions, it is of the utmost importance that outside visual search sectors be assigned and defined for each crewmember. Whenever the crewmember responsible for a given sector is unable to scan his sector; e.g., changing radio frequencies, he will so announce and another crewmember will be assigned the responsibility during the interim. During night/NVG operations, the pilot flying is responsible for maintaining aircraft control, ensuring obstacle avoidance, and requesting assistance from the other crewmembers. The pilot not flying performs all equipment and instrument checks, selects radio frequencies, assists in clearing the aircraft, and serves as the navigator. The crew chief performs those duties assigned by the PC.

2. During actual or simulated emergencies, each crewmember performs as briefed. Normally, the pilot flying will initiate those immediate action steps to maintain aircraft control. He must determine whether to remain goggled or make the transition to unaided visual flight. The pilot not flying will assist as requested.

REFERENCES:

FM 1-203
FM 1-204
TC 1-201
TM 55-1520-237-10
Unit SOP

Appendix C

BQ Four-Element Teaching Format

Basic Quality 5: Management of Unexpected Events

5. Definition of Basic Quality 5: (Student Handout, p. 1-64)

This Basic Quality measures the crew's performance under unusual circumstances that may involve high levels of stress. Both the technical and managerial aspects of coping with the situation are important.

6. Management of Unexpected Events

S-VG 116

a. Types of unexpected events

(1) Malfunctions

- What types of malfunctions would involve crew coordination? (Hydraulic failures, stabilator failures, two-way radio failures)

(2) Inadvertent IMC

- What crew coordination actions are required for IMC? (Radio contacts, VHIRP procedures, finding and briefing approach plates)

(3) Encounters with threat

(4) Sudden loss of visual reference near the ground

- Whiteout and brownout

(5) Unusual environmental conditions

- Windshear, turbulence, downdrafts

(6) Near mid-air collisions

(7) Short notice in-flight mission change

S-VG 117

- b. Preparing for unexpected events
 - (1) Technical and tactical proficiency
 - Knowledge
 - Training
 - Practice
 - (2) Premission planning and rehearsal
 - Assigning duties and responsibilities
 - Rehearsing "anticipated" events
 - (3) Reminders during in-flight periods of low workload

S-VG 118

- c. Coping with unexpected events through interrelated use of all available resources
 - (1) Internal resources
 - Aircrew (self and others)
 - Equipment (aircraft systems)
 - Information (maps, checklists, -10)
 - (2) External resources
 - Time (conserve through planning)
 - Other aircraft
 - Tactical controlling agency
 - ATC
 - Technical representatives

7. Performance Criteria for Basic Quality 5: Management of Unexpected Events
(see *Student Guide*, Appendix E, Basic Quality 5)

- If the crew is prepared to handle unexpected events, the impact on mission safety, efficiency, and effectiveness will be minimized. Rating factors and examples of Superior, Acceptable, and Very Poor performance for this BQ are as follows:

S-VG 119

Rating Factors:

Crew Preparation and Composure

<i>Superior</i>	+	Crew actions reflect extensive rehearsal of emergency procedures in prior training and premission planning and rehearsal
	+	Crewmember actions and information exchange are highly coordinated with minimal verbal direction from the PC
	+	Crewmembers respond in a composed, professional manner
<i>Acceptable</i>	•	Crew actions reflect consistent understanding of emergency procedures; responses are adequately standardized to avoid significant conflicts or misunderstandings
	•	Crewmember actions and information exchange proceed smoothly, although moderate direction from the PC is necessary
	•	Crew composure is tense, but not flustered
<i>Very Poor</i>	-	Crew actions reflect misunderstanding of emergency procedures; little or no evidence of prior rehearsal during training or premission planning
	-	Crew actions and information exchange require extensive direction from the PC in order to avoid significant conflicts or misunderstandings
	-	Crew composure is disorganized and flustered

S-VG 120

Resource Management

<i>Superior</i>	+	Each crewmember appropriately or voluntarily adjusts individual workload and task priorities with minimal verbal direction from the PC
	+	Each crewmember is effectively utilized in responding to the emergency; workload is efficiently distributed

-
- | | | |
|------------|---|---|
| Acceptable | • | Each crewmember appropriately adjusts workload and task priorities, although moderate direction from the PC is necessary |
| | • | Each crewmember is utilized in responding to the emergency, with no major maldistributions of workload |
| Very Poor | - | One or more crewmembers fails to appropriately adjust workload during the course of the unexpected event resulting in a significant compromise to flight safety |
| | - | One or more crewmembers is inappropriately utilized or underutilized, resulting in a significant compromise to flight safety or mission performance; other crewmembers experience task overload |

S-VG 121

8. Illustrations of Basic Quality 5: Management of Unexpected Events (see Appendix B and *Student Guide*, Appendix D)

VT 06

Note: Recommend discussing case number(s) 3-9, UH-60 NVG Training Flight, from the Case Study Selection Matrix extract on the following page; show Eastern 401 video segment.

Appendix D
Case Study Extract

GROUP #1: ESTABLISH AND MAINTAIN TEAM RELATIONSHIPS

Example 1-1: UH-1N NVG Training Flight (USMC)

During an NVG multi-aircraft operation (Army ATM Task 2009), a flight of two aircraft were practicing terrain flight navigation. The PC of the lead aircraft was under pressure from collateral duties within the unit. He was also known for his harsh treatment of subordinates. Three weeks earlier, he had a run-in with the CE of his aircraft, accusing him of sabotage when the aircraft had binding controls. The CE reported this to the unit commander who subsequently counseled the PC.

The unit had been bivouacked in harsh conditions and the OPTEMPO was intense for the last 4 months, resulting in evident fatigue among all members of the unit. Unit SOP required the crew of the wing ship of two ship flights to monitor lead's navigation and call a code word over the mission frequency if they detected that lead was deviating from the planned route. On a previous mission, the crew of the wing ship had done this several times to the PC of lead, only to have him reprimand them for breaking radio silence when the mission was over.

On this mission, the crew of the wing ship observed lead once again "flying off the top of the map." After watching lead make two course reversals, then fly off the map again, the crew of wing discussed calling the code word over the mission frequency. The PC of the wing ship said "he just chewed our ass for radio discipline,...let him continue for a few more minutes, then we'll call the code word." Approximately 45 seconds later, wing observed lead impact wires and crash.

Crew Coordination Objective: Establish and maintain team relationships

Crew Coordination Basic Quality: Establish and maintain flight team leadership and crew climate

ATM Crew Coordination Element: Provide aircraft control and obstacle advisories

Appendix E
Accident Examples

Failure of the P* to properly direct assistance from the other crewmembers.

Definition:

Good aircrew coordination requires that the P* requests assistance during critical maneuvers, when monitoring flight parameters, or when performing required actions inside the cockpit. The crew coordination error occurs when crewmembers possess an "I can do this myself" attitude. When nonflying crewmembers are not directed to assist in the highest priority task, the error then involves a failure to recognize task priority, rather than a failure to utilize all available crew resources.

Examples:

1-1 The PC* assumed the controls from the P after the P had experienced difficulty in correctly aligning a night, unaided approach to a poorly illuminated landing zone (landing zone was obscured by background lights from a nearby town). Instead of directing the P to assist in monitoring and calling out airspeed and altitude, the PC* relied on degraded visual references to control his approach. The P called out "Watch your closure," but was unable to provide sufficient warning before the aircraft descended into trees and crashed. [UH-60A]

1-2 After flying more than two hours under NVG conditions, the P* announced that he was too tired to continue on the controls during a search and rescue mission. The PC assumed the controls, but failed to (1) determine if the P was able to provide further assistance and (2) direct the P to assist in terrain flight map navigation and obstacle avoidance.

Continuing with the mission, the PC* attempted a terrain flight approach along a valley to an intended landing site. Subsequently, the aircraft struck a set of high tension wires extending across the approach valley. [UH-60A]

1-3 On a night, unaided mission over water, the PC* assumed the controls at 100 feet AGL and attempted to maneuver underneath a thunderstorm. Without directing the P to assist in monitoring and calling out altitude, the PC* began to perform a number of tasks simultaneously: instrument cross checks, radio calls, aircraft control, and reset of the force trim switch. The PC* subsequently became task saturated and allowed the aircraft to descend unnoticed into the water. [OH-58C]

1-4 During an NVG flight at 400 feet AGL, the aircrew experienced a low engine RPM warning signal. Without requesting the P to perform an engine cross check (required by the aircraft's

technical manual), the PC* erroneously assumed that an engine failure had occurred and began to set the aircraft up for an NVG autorotation. Without announcing his intentions, the P removed his goggles and turned on both the white landing light and the white cockpit lights. The landing light came on momentarily and burned out, leaving both crewmembers temporarily blinded. The subsequent autorotation was performed poorly because of degraded visual references and the aircraft struck the ground. [OH-58C]

1-5 The PC* was making a second attempted aft wheel landing to a 25° sloping terrain. Instead of directing the CE to provide rear clearance assistance with the aft main rotor blades, the PC* directed the CE to "Call the wheels down." This action required the CE to lie face down with his head extended over the ramp. In this position, the CE was unable to properly judge main rotor blade clearance with the sloping terrain. Subsequently, the aft main rotor blades struck the sloping terrain as the PC* lowered the aircraft. [CH-47B]

Selected Accidents by ATM Tasks

Task 1007: Perform Engine Start, Run-up, and Before-Takeoff Checks

OH-58 crew was preparing for a night test flight to determine the compatibility of NVGs with a new type of NBC mask. The P was wearing an NBC suit for test purposes. The P was experiencing difficulty ingressing the aircraft. Without waiting for the P to be properly seated and in a position to perform/assist in the engine start, the IP* initiated an unsuccessful engine start from the left seat using the throttle control on the left seat collective and the trigger on the right seat collective. The IP* failed to fully close the throttle after the initial start attempt. The IP* initiated a second start attempt before the P was connected to the IC and in a position to perform/assist in the engine start. The second attempt resulted in a hot start (due to the open throttle) and destruction of the OH-58 engine.

Task 1015: Perform Ground Taxi

1. CH-47C was landing at a small airfield (with no taxiway markings) for refueling. The PC* ground taxied the aircraft near a hangar and became concerned that the aircraft was too close. He received clearance to the right from the FE but failed to wait for left rear clearance from the CE who was lowering the ramp to clear. As a result, when the aircraft turned right, the rear swung left and the aft rotor struck the hangar.
2. UH-60A had ground-taxed to a maintenance hot spot when PC in right seat decided to reposition because they were blocking another aircraft parked closely to their left. PC directed P* to start forward but failed to direct the CE (seated behind the PC) to either switch seats or act as ground guide to assist P* in clearing aircraft on left. As a result, P* misjudged clearance and main rotor struck tail of parked aircraft.
3. UH-60A was performing ground taxi to a refueling point on left side of aircraft. P warned PC* that they were getting close. PC* acknowledged and improperly directed P to lock tail wheel. Thus, P's attention was focused inside and diverted from the primary task of clearing left. As a result, PC* misjudged clearance and main rotor struck a pole at the refueling point on left side of aircraft.

Appendix F

Practical Exercise Example

GENERAL SITUATION

You are the PC of a UH-60A helicopter operating in an unfamiliar area of operations (AO). The terrain is generally wooded, rolling terrain with small hill masses scattered throughout the southwest portion of the AO. Your crew is rated CRL 1 and your pilot is a newly assigned W1 with less than 350 total flying hours. Your CE and door gunner have been with the unit for 12 months and 6 months, respectively. Your crew has not flown for the last two days. You have been assigned the following mission:

Depart your assembly area (AA) and fly to PZ Grape, located 13 kilometers west of the AA. Pick up and deliver supplies to supported units located at:

- LZ Apple located 32 kilometers southwest of PZ Grape. This is an internal load weighing approximately 5300 lbs.
- LZ Orange located 23 kilometers southeast of PZ Grape. This is an external load weighing approximately 5600 lbs.

Both of these supported units are located within 5 kilometers of the FLOT. You are to depart the AA at 0100Z (2200 local), which is 50 minutes from now. The entire mission will be flown under NVGs. Refuel as necessary. The FARP is located 6 kilometers east of the AA. Your assigned aircraft has been preflighted and flown by another crew during the day. They reported that all systems are operational, and the aircraft has been refueled with a total of 200 gallons of JP5.

The local weather has been influenced by a stalled low pressure system for the last two days with low ceilings, reduced visibilities, and rain showers. Occasional thunderstorm activity has been reported in the area of operations. Nighttime temperatures have been averaging 19°C. Winds have been light and variable except in the vicinity of the thunderstorms. Tonight's weather will include 500 to 1000 foot ceilings, 2 to 3 kilometers visibility, fog, and occasional rain showers.

PRACTICAL EXERCISE

Prioritize your crew's mission planning activities by placing a number from 1-10 in the space next to the 10 activities listed on the following page. This number indicates the order (1 = highest priority) in which you would accomplish the planning task, given the circumstances described in the general situation and the time available. Also indicate whether the task should be done prior to takeoff (A) or if it can be done in the aircraft (B); e.g., 1A for reviewing NOTAMs, etc. (An acronym list is provided at the bottom of the practical exercise for your convenience.)

-
- Map reconnaissance
 - Review enemy/friendly reports
 - Review NOTAMs
 - Assess mission requirements including effects of weather and lighting, enemy/friendly force deployments, terrain, and radio navigation
 - Select modes of terrain flight
 - Select movement techniques
 - Select main and alternate routes
 - Compute and determine time, distance, headings, expected airspeeds and altitudes, fuel requirements, and armament requirements
 - Annotate map or overlay with routes (course lines, corridors, or axis), unit boundaries, time tic marks, critical turns, air passage points, LZs, PZs, RPs, SPs, ACPs, CCPs, FARPS, FLOT or LD/LC, enemy and friendly positions, battle positions, phase lines, radio navigation aids, hazards, fire support preplans, and downed pilot pickup points
 - Performance planning including weight and balance, power requirements, and fuel consumption and endurance

AA	Assembly Area	LD	Line of Departure
ACP	Air Control Point	LZ	Landing Zone
AO	Area of Operations		
CCP	Coordination Check Point	NOTAM	Notices to Airmen
CE	Crew Engineer/Crew Chief	NVG	Night Vision Goggles
CRL	Crew Readiness Level	PZ	Pick-up Zone
FARP	Forward Arming and Refuel Point	RP	Release Point
FLOT	Forward Line Own Troops	SP	Start Point
LC	Line of Contact		

Appendix G

Instructor Read-Ahead

Instructor Read-Ahead

Welcome to the Aircrew Coordination Trainer Course!

How many times have you, as an IP or UT, attempted to expedite the departure process by starting the aircraft without the assistance of the other crewmember? It may be understandable when you're working with new students who have limited knowledge of the procedures but what about when you're working with a fellow rated crewmember or rated student pilot? Is such IP action justifiable then? What is the role of the IP or UT during normal unit missions or check rides in two-place aircraft? (These and other questions will be explored during the Aircrew Coordination Trainer Course.)

One thing is clear from the example—the crewmembers were *not* operating as a CREW! At the time, it did not seem as though there were circumstances that would require a rushed departure. One could assume that it was probably business as usual—and possibly a normal pattern of behavior for the IP. But—it was a TEST flight and not a check ride and *both* crewmembers should have been involved in the start-up and run-up checks of the aircraft. Was it the result of a particular mind set that led this particular IP to perform the Ps' functions without notification? Could not the IP have

delayed the start-up procedure and, in this case, saved an engine? These are questions that basically attack "the old way of doing things" and their answers in terms of aircrew coordination principles indicate that there must be a significant attitudinal change before we fully realize the benefits of the crew approach to flying an aircraft.

Is this attitudinal change possible? The answer is a resounding "Yes!!!" as evidenced by the U.S. Army's ground-breaking research on line aviation units. The lessons learned through this pioneering work are included in the Aircrew Coordination Course you are about to attend and, later, teach to your unit aircrews.

The crew was preparing for a night test flight to determine the compatibility of NVGs with a new type of NBC mask. The P, wearing an NBC suit for test purposes, was experiencing difficulty ingressing the aircraft. Without waiting for the P to be properly seated and in a position to perform/assist in the engine start, the IP, who was on the controls, initiated an unsuccessful engine start from the left seat using the throttle control on the left seat collective and the trigger on the right seat collective. The IP failed to fully close the throttle after the initial start attempt. The IP then initiated a second start attempt before the P was connected to the IC and in position to perform or assist in the engine start. The second attempt resulted in a hot start (due to the open throttle) and destruction of the aircraft engine.

As an Aircrew Coordination Instructor, you have a critical role in bringing about the attitudinal change necessary for the Army to fully implement the crew approach to flight operations. Clearly, the Army has decided to change its training and evaluation focus from individual aviators to crews. This is a major shift in direction and your contribution is pivotal to its success. However, you, as an instructor, cannot "sell" the program to your students if you do not show a personal commitment to the

objectives of the Crew Coordination Program. Before this can happen, your Trainer Course instructors will show you the soundness of the program and hopefully make you a believer, too. In this manner, the attitudinal change we spoke of will be perpetuated throughout the Army down to every crewmember, both rated and nonrated. And how will we prepare you for this important role? Through training—pure and simple—and by supporting you in your role as trainer. Let's now look at the history of the training you will receive.

Aircrew coordination interest stems from the commercial airlines' discovery that mechanically safe aircraft were crashing for no apparent reason. Upon investigation, the U.S. Army found a similar trend in its Class A, B, and C accidents occurring during the period FY 84-89. Roughly 15% of the 596 accidents analyzed were classified as crew coordination error. Of these 15%, 41% were attributable to communications failures and 35% to workload and prioritization factors. Results of the analysis laid the basis for the development of a group of principles, designated as Crew Coordination Elements, which were incorporated into the rewrite of the training circulars governing aircrew training. Concurrent with these actions, work was progressing toward the development of an aircrew coordination course based on the results of an Army research study undertaken to validate aircrew coordination measurement materials. These measurement materials were necessary because, as with any training effort, if the results of aircrew coordination training were not measurable, then what would be the training benefits to be gained from the investment of resources required? In this case, the measurement materials were validated and work was begun to develop the academic instruction based on proven research models that

described the aircrew coordination process. The result of that effort is the Aircrew Coordination Course.

Over the next several days of the Trainer Course you will be primarily trained in the presentation of the Aircrew Coordination Course. You will learn the Methods of Instruction (MOI) and then, in the role of student, we will present the entire Aircrew Coordination Course to you. Next, we will discuss the evaluation system and how to develop supporting scenarios based on your unit METL. Finally, we will go step-by-step through Scenario Familiarization and Evaluation so that you can learn and experience the exact procedure you will be guiding your unit aviators through when you begin to instruct the course—which is your next step.

Once you return to your unit, you will begin preparations to instruct your unit aircrews. An important part of your preparation is developing scenarios to support your aircrew coordination training and evaluating the effects—just like you learned in the Trainer Course. You will also need to schedule training, students, classrooms and simulators; assign blocks of instruction to other trainer team members so that all subjects are covered without anyone being overloaded; reproduce and distribute training materials; and, lastly, ensure that everything comes together as planned.

After you train and evaluate your unit aviation personnel, you can then assess the effectiveness of your program. You can do this by analyzing the Aircrew Coordination Grade Slips to detect shortcomings indicated by the number of particular Basic Qualities found to be lacking during evaluation rides. This fine-tuning process will continue for as long as the course is taught, thereby allowing the incorporation

of lessons learned to enhance the training experience.

To prepare yourself for the first and subsequent days of the course, you should read the following articles from Appendix G of your *Student Guide*:

For hours 1-6, pages G-1 to G-54

For hours 7-12, pages G-55 to G-100

For hours 13-18, pages G-101 to G-129

(Complete the PEs as directed by your instructor; i.e., either in class or at home.)

~ Once again, welcome to the Aircrew Coordination Program. You are a key player in this program and extremely important to its success. Please do not hesitate to call on your instructors at any time if you need assistance. ~

Appendix H
Student Read-Aheads

Student Read-Ahead 1

Welcome to the Aircrew Coordination Course!

The mishap described below exemplifies noncompliance with many of the aircrew coordination principles that you will learn about in the Aircrew Coordination Course. More than anything, the example shows that the crewmembers were *not* operating as a CREW!! Rather, the mishap crewmembers fit the mold of what MG Robinson, CG, USAA-VNC, referred to as the "single pilot mentality." Such an approach to flying duties is not acceptable!

Aircrew coordination failures, such as the one shown above, were a major reason for the development of, and your attendance at, the Aircrew Coordination Course. You will be trained to recognize and avoid aircrew coordination failures. Furthermore, you will be taught several techniques to fully utilize your fellow crewmembers' capabilities.

Before you begin your classroom instruction, you will participate in a pretraining ride to prepare you for the type of training missions you can expect. Items necessary for you to plan the flight will be issued shortly.

You will be expected to accomplish pre-mission planning and rehearsal, mission

execution, and a crew-level after-action review for this pretraining ride mission—but without any pressure attributable to evaluation—there is none! So relax and do your best. Use your previous training and experience—and any doctrinal publications that you presently use. Then, during the course, you and your crewmembers will have a common, recent basis for comparing your past performance with your expected performance after you learn the aircrew coordination techniques being taught in the course. We suspect that these comparisons will be quite interesting—and productive as well!

After your pretraining ride, you will receive another read-ahead and your course training materials. And, subsequent to your classroom instruction, you and your fellow crewmembers, both rated and nonrated, will plan and execute several simulator- or aircraft-based missions derived from your unit mission essential task list (METL). For now, don't worry about what lies ahead—concentrate on the mission at hand.

Any questions you have will be answered by your instructors when the course begins.

On a night, unaided mission over water, the PC assumed the controls at 100 feet AGL and attempted to maneuver underneath a thunderstorm. Without directing the P to assist in monitoring and calling out altitude, the PC began to perform a number of tasks simultaneously: instrument cross checks, radio calls, aircraft control, and reset of the force trim switch. The PC subsequently became task saturated and allowed the aircraft to descend unnoticed into the water.

~ Again, welcome to the Aircrew Coordination Course! ~

Student Read-Ahead 2

Welcome to the Aircrew Coordination Course Classroom Instruction!

As with the example shown on the first read-ahead, this accident exemplifies the "single-pilot" mentality. Besides the obvious lack of crew-based premission flight planning and briefing, the P was guilty of the "Co-pilot Syndrome" and believed his own best interests were being looked after by others—only to be sadly disillusioned. Aircrew coordination training will teach you, as P or PC, to preclude such accidents from happening.

One technique you will learn is the "Two-challenge Rule"—a rule which would have mentally prepared the P in the example to assume the controls from the PC where loss of life was imminent. We must all recognize that we are fallible and where tragedy can result, it is morally unconscionable for us not to act—regardless of who is on the controls. But how did we get to this stage of thinking?

During your classroom instruction, we will cover the history of aircrew coordination, beginning with the commercial airlines' realization that mechanically safe aircraft were crashing for no apparent reason. The US Army Research Institute and the US Army Safety Center later conducted an analysis and found that of 596 Class A, B, and C accidents occurring between FY 84-

89, 15% (88) were due to crew coordination error. Of these 88 accidents, 41% involved communication failures and 36% resulted from workload or prioritization failures. From these accidents, six categories of

aircrew coordination failures were identified:

- ❖ failure of the pilot on the controls to direct assistance
- ❖ failure of a crew-member to announce a decision or action
- ❖ failure of crew-members to communicate positively
- ❖ failure of the PC to assign crew responsibilities
- ❖ failure of crew-members to offer assistance or information, and
- ❖ failure to perform flight actions in the proper sequence.

As a result of these findings, Army aviation officials took several significant actions:

TC 1-210, Aircrew Training Program, and the Aircrew Training Manuals (ATMs) for each mission-type aircraft were rewritten to incorporate the analysis findings, and, concurrently, action was taken to develop the Aircrew Coordination Course, which you are now attending.

The Aircrew Coordination Course embodies several new concepts and models that you will soon be introduced to, such as Crew

Despite the fact that neither crew-member was mountain qualified, the PC, who was on the controls, attempted to demonstrate mountain flying tactics on a training mission. In addition, the PC failed to properly complete the PPC for the anticipated flight conditions. Finally, the PC considered the OGE hover check conducted at 6,000 feet MSL to be adequate for predicting available power at the mission altitude of 9,180 feet MSL. While attempting an NOE masking/unmasking maneuver at this higher altitude, the PC lost directional control of the aircraft and permitted it to crash into wooded terrain. The P failed to challenge any of the PC's actions or decisions during this mission.

Coordination Elements, Crew Coordination Objectives, and Basic Qualities.

From the aviation accident analysis discussed above, you will discuss the eight Crew Coordination Elements built into the ATM tasks. These elements are: Communicate positively, direct assistance, announce actions, offer assistance, acknowledge actions, be explicit, provide aircraft control and obstacle advisories, and coordinate action sequence and timing. Sound familiar? Of course they do; they're right out of your ATM!

You will also discuss the Crew Coordination Objectives. These objectives, validated by Army research data on line aviation units, are central to the functions that all crewmembers perform: Plan, Assess, Resolve, and Execute. But what exactly are the Crew Coordination Objectives? They are behaviors to be instilled in each rated and nonrated crewmember. Once instilled, we must then measure achievement of the Crew Coordination Objectives with respect to the ATM tasks—the tasks that form the basis for flight training and evaluation—using the Basic Qualities.

Definitions for each of the Basic Qualities, as well as for the Crew Coordination Elements and Crew Coordination Objectives, will be discussed during your classroom instruction. In preparation for that instruction, the relationship of the Basic Qualities to the Crew Coordination Objectives is shown below:

CCO 1: Establish and maintain team relationships

BQ 1: Establish and maintain flight team leadership and crew climate

CCO 2: Mission planning and rehearsal

BQ 2: Pre-mission planning and rehearsal accomplished

BQ 3: Application of decision making techniques

CCO 3: Establish and maintain workload levels

BQ 4: Prioritize actions and distribute workload

BQ 5: Management of unexpected events

CCO 4: Exchange mission information

BQ 6: Statements and directives clear, timely, relevant, complete, and verified

BQ 7: Maintenance of mission situational awareness

BQ 8: Decisions and actions communicated and acknowledged

BQ 9: Supporting information and actions sought from crew

CCO 5: Cross-monitor performance.

BQ 10: Crewmember actions mutually cross-monitored

BQ 11: Supporting information and actions offered by crew

BQ 12: Advocacy and assertion practiced

BQ 13: Crew-level after-action reviews accomplished

But how do the ATM tasks, Basic Qualities, and Crew Coordination Objectives relate to one another? The Crew Coordination in Army Aviation graphic depicts this relationship (Figure 1). And, the relationship of the Crew Coordination Objectives to the crew cyclical functions is shown in the Crew Coordination Model (Figure 2). We will use these two training aids throughout the course to firmly establish the relationships among the many aircrew coordination components. This is what makes the Army aircrew coordination training different from all other crew coordination courses: We know what the components of aircrew coordination are, how to train aviation personnel in their use, and how to measure them—another subject you will be introduced to during the course.

What other innovative ideas are introduced in the Aircrew Coordination Course? Besides the models and the concepts they depict, we use case studies based on actual Army accidents to analyze aircrew coordination failures. Several of the cases are supported vividly by videotape presentations, which you will analyze in small groups. Case studies are included in Appendix D of your *Student Guide*. But, the major instructional technique that makes this course so effective is the simulator or flight hands-on training, which reinforces the techniques you learned in the classroom before you forget them—as happens in so many other courses!

As mentioned in your first read-ahead, in addition to the pretraining ride, you will

have three rides based on the crawl-walk-run concept. This approach to training will be explained to you during the course and put into practice so that you may experience the benefits of its application.

Practically speaking, what can you do to get the most from the Aircrew Coordination Course? Without exception, be prepared for each day's activities whether they are in the classroom or in the cockpit. In this respect, it's no different from being back in the unit; so the course will not be demanding anything different from you in terms of commitment. Judging from past students, we know you will soon get wrapped up in the subject matter and will probably even begin applying the techniques learned on the job to your personal life as well. So, what can you do to be better prepared? Complete the assigned background reading and practical exercises to be discussed during the following day's instruction. That way you can assist the instructor by keeping up with the accelerated pace demanded by the course. The readings from Appendix G of your *Student Guide* are:

For hours 1-6, pages G-1 to G-54

For hours 7-12, pages G-55 to G-100

For hours 13-18, pages G-101 to G-130

(Complete the PEs as directed by your instructor; i.e., either in class or at home.)

~ Once again, welcome to the Aircrew Coordination Course. Your instructional staff is here to assist you in any way possible. We are committed to making this the best course of instruction you have ever attended; and it is the best because, as other Army aviation crew coordination graduates have stated, "Someday this course will save my life!" ~

Appendix I

Background Reading Abstracts

Background Reading

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<i>Army Aviation's shift in training philosophy places emphasis on the crew's ability to train and work together as a team</i>	
Aircrew Coordination Training - A New Approach	G-9
<i>US Army Research Institute advocates an approach to aircrew coordination training which is ATM task-oriented and makes specific use of Army flight simulators</i>	
The Crew Coordination Model	G-17
<i>The basic model of operator functions provides the elements for the Crew Coordination Model, the conceptual basis for the Army's Aircrew Coordination Training program</i>	
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Appendix J

After-Action Review Checklist

Table 3-2. Crew-level After-action Review Checklist

1. All crewmembers present.
2. Restate mission objectives.
3. METT-T considerations.
- 4.* Conduct review for each mission segment:
 - a. Restate planned actions/interactions for the segment.
 - b. What actually happened?
 - (1) Each crewmember states in own words.
 - (2) Discuss impacts of crew coordination requirements, aircraft/equipment operation, tactics, commander's intent, etc.
 - c. What was right or wrong about what happened?
 - (1) Each crewmember states in own words.
 - (2) Explore causative factors for both favorable and unfavorable events.
 - (3) Discuss crew coordination strengths and weaknesses in dealing with each event.
 - d. What must be done differently the next time?
 - (1) Each crewmember states in own words.
 - (2) Identify improvements required in the areas of team relationships, mission planning, workload distribution and prioritization, information exchange, and cross-monitoring of performance.
 - e. What are the lessons learned?
 - (1) Each crewmember states in own words.
 - (2) Are changes necessary to:
 - (a) Crew coordination techniques?
 - (b) Flying techniques?
 - (c) SOP?
 - (d) Doctrine, ATM, TMs?
5. Effect of segment actions and interactions on the overall mission?
 - (1) Each crewmember states in own words.
 - (2) Lessons learned?
 - (a) Individual level.
 - (b) Crew level.
 - (c) Unit level.
6. Dismiss crewmembers.
7. Advise Operations of significant lessons learned.
8. Incorporate significant lessons learned in subsequent missions.

* This step may also be accomplished during periods of low in-flight workload to resolve disagreement or to critique significant decisions, actions, and interactions affecting mission performance. In-flight review of a segment does not preclude its coverage during the AAR.

Appendix K

Introducing the Aircrew Coordination Exportable Training Package

Introducing the Aircrew Coordination Exportable Training Package

The Aircrew Coordination Exportable Training Package comprises two complete courses: The Aircrew Coordination Trainer Course and the Aircrew Coordination Course. Included in the package are the three course guides used in the conduct of the two courses and the reproducible materials required to support instruction. The course guides and reproducible materials are described in detail below. Following the description of this material, the procedures to conduct each of the two courses are provided.

..... Description of the Course Guides and Reproducible Materials

As stated above, the Aircrew Coordination Exportable Training Package includes three course guides together with the reproducibles required to support the classroom, simulator, or flight instruction.

The three course guides are the:

- Aircrew Coordination Course Trainer Guide

The *Trainer Guide* is used by trainers (USAAVNC certified instructors*) during the Aircrew Coordination Trainer Course to instruct unit instructors (unit IPs, UTs, and IOs) who will subsequently conduct the Aircrew Coordination Course to train and evaluate unit aircrews.

(*Certified means received the Aircrew Coordination Trainer Course and taught the Aircrew Coordination Course under supervision.)

- Aircrew Coordination Course Instructor Guide

The *Instructor Guide* is used by unit instructors 1) to take notes during the Trainer Course and 2) to conduct the Aircrew Coordination Course.

- Aircrew Coordination Course Student Guide

The *Student Guide* is used by the aircrews for note taking and reference purposes while attending the Aircrew Coordination Course.

The reproducibles, which are contained in the Reproducible Box, include the material that is used during the conduct of the courses and, therefore, cannot be reused in subsequent courses; thus, this material must be reproduced before the start of each new

course. The most cost effective means of reproduction is to have materials printed through the local Training Aids Support Center (TASC). The reproducible materials are listed in the following table and are noted in text here and throughout the three guides where appropriate.

Reproducible Materials

Materials	Guide and section in which the material is located
Instructor Read-Ahead	<i>Trainer Guide</i> , Appendix A. Trainers will issue to unit instructors one week prior to the start of the Aircrew Coordination Trainer Course.
Student Read-Aheads	<i>Instructor Guide</i> , Appendix A. For the Trainer Course, trainers will issue Student Read-Ahead 1 to unit instructors prior to the pretraining ride and Student Read-Ahead 2 subsequent to the pretraining ride. For the Aircrew Coordination Course, instructors will provide the Student Read-Aheads to unit aircrews on the same basis.
Grade Slips	<i>Instructor Guide</i> , Appendix C. Grade slips are used by the trainers and unit instructors to evaluate aircrew coordination. As such, sufficient numbers must be reproduced prior to the start of each new course and distributed as necessary.
Practical Exercises	<i>Instructor Guide</i> , Appendix G. Instructors will pass out to students during the Aircrew Coordination Course. Students will insert the exercises into Section 2 of their <i>Student Guide</i> .
Student Handout	<i>Student Guide</i> , Section 1. This is an outline form of the Aircrew Coordination Course on which the students will take notes. Before the start of each new course, instructors will reproduce this section and insert it into the <i>Student Guide</i> .

The following sections describe in detail each of the course guides, how the guides are used, and the reproducible materials supporting each course.

Trainer Guide

The *Trainer Guide* contains a lead-in outlining the conduct of the Aircrew Coordination Trainer Course, five major sections, and a supporting appendix. Trainers use the *Trainer Guide*, together with the *Instructor Guide* and the *Student Guide*, to conduct the Trainer Course. (Note: Because the *Instructor Guide* and *Student Guide* will be required by the unit instructors to conduct the Aircrew Coordination Course, the unit instructors will keep the guides upon completion of the course.) Each of the parts of the Trainer Guide is explained below.

About the Trainer Course: Provides the trainer with the information necessary to conduct the Aircrew Coordination Trainer Course.

Section 1 - Course Introduction and Learning Objectives: Administrative details covering course conduct, together with the terminal and enabling learning objectives, are outlined for the general information of the students. (Section 1 of the *Instructor Guide* is an outline form of this section, on which unit instructors will take notes during the Trainer Course.)

Section 2 - Methods of Instruction: Presents instructional techniques and background information on the unique features of the course necessary for unit instructors to effectively teach the course to aircrews of their respective organizations. Included in this section is the rationale underlying the structure of the course, an explanation of the interrelationships between the various components composing the course, and the instructional techniques recommended to effectively present the Classroom Instruction and the hands-on simulator or flight training instruction. (Section 2 of the *Instructor Guide* is an outline form of this section, on which unit instructors will take notes during the Trainer Course.)

Section 3 - Aircrew Coordination Course: At this point in the Trainer Course, unit instructors are referred to Section 3 of the *Instructor Guide*, and the Aircrew Coordination Course is presented in its entirety, including the scenario or flight training. Being involved in the actual conduct of the Aircrew Coordination Course will provide unit instructors with the necessary experience on which to base their own presentation of the Aircrew Coordination Course.

Section 4 - Evaluation Procedures and Scenario Development: Provides unit instructors with the information and techniques necessary to develop scenarios and to evaluate unit aircrews undergoing initial crew coordination training. Unit instructors are provided the hands-on opportunity to use the information and forms required to objectively evaluate aircrews on their application of the crew coordination principles. (Section 4 of the *Instructor Guide* is an outline form of this section, on which unit instructors will take notes during the Trainer Course.)

Section 5 - Scenario Familiarization and Evaluation: Introduces unit instructors to the types of scenarios best suited for the conduct of crew coordination training. Unit instructors will also be given hands-on practice at applying the evaluation procedures taught in the previous section through the rating of crews made up of fellow unit instructors. (Section 5 of the *Instructor Guide* is an outline form of this section, on which unit instructors will take notes during the Trainer Course.)

Appendix A - Instructor Read-Ahead: The Instructor Read-Ahead is issued by the trainer cadre to each unit instructor at least one week before they attend the Aircrew Coordination Trainer Course. Because the trainers will have to provide a copy of the read-ahead to each member attending each of the Aircrew Coordination Trainer Courses, the read-ahead is provided as a reproducible. No other parts of the Trainer Guide need to be reproduced for distribution to the unit instructors.

Instructor Guide

The *Instructor Guide* mirrors the *Trainer Guide*; it has an Introduction, five major sections, and supporting appendices. As stated earlier, unit instructors will use the *Instructor Guide* to take notes during the Trainer Course and to conduct the Aircrew Coordination Course. (Unit instructors will also be provided a copy of the *Student Guide* and instructed on how they will use it when they conduct the Aircrew Coordination Course.)

Introducing the Instructor Guide: The purpose and use of the *Instructor Guide* is explained, together with a description of the major parts and their function in the presentation of the Aircrew Coordination Course.

Section 1 - Course Introduction and Learning Objectives: Provides 1) an area for the recording of administrative data pertinent to the conduct of the Aircrew Coordination Trainer Course and 2) the terminal and enabling learning objectives of the course.

Section 2 - Methods of Instruction: This is an outline form of Section 1 of the *Trainer Guide*. Unit instructors will take notes on this outline during presentation of the Aircrew Coordination Trainer Course and will use it for future reference when conducting the Aircrew Coordination Course.

Section 3 - Aircrew Coordination Course. This section contains all of the information necessary for the unit instructors to subsequently teach the Aircrew Coordination Course to unit rated and nonrated crewmembers. The section is divided into three parts:

About the Aircrew Coordination Course: Provides unit instructors with the information necessary to conduct the Aircrew Coordination Course.

Classroom Instruction: Provides the 1) the administrative data pertinent to the conduct of the Aircrew Coordination Course, 2) the terminal and enabling learning objectives of the course, and 3) the information required by unit rated and nonrated crewmembers to understand and apply the principles of crew coordination during training and evaluation rides in the simulator or aircraft.

Simulator or Flight Training and Evaluation: Provides the hands-on opportunity for unit rated and nonrated crewmembers to apply, and be evaluated on the application of, the crew coordination principles learned in the classroom.

Section 4 - Evaluation Procedures and Scenario Development: This is an outline form of Section 4 of the *Trainer Guide*. Unit instructors will take notes on this outline during presentation of the Aircrew Coordination Trainer Course and will use it for future reference when conducting the Aircrew Coordination Course.

Section 5 - Scenario Familiarization and Evaluation: This is an outline form of Section 5 of the *Trainer Guide*. Unit instructors will take notes on this outline during presentation of the Aircrew Coordination Trainer Course and will use it for future reference when conducting the Aircrew Coordination Course.

Appendix A - Student Read-Aheads: Because trainers and unit instructors will have to provide a copy of each of the two read-aheads contained in the appendix, they are provided as reproducibles and, therefore, can be prepared before the start of each new course and distributed as necessary. For the Trainer Course, Student Read-Aheads 1 and 2 will be provided by the trainers to the unit instructors prior and subsequent to the pretraining ride, respectively. For the Aircrew Coordination Course, unit instructors will furnish the Student Read-Aheads to unit aircrews on the same basis.

Appendix B - Case Study Discussion Guide: Broken wing awards and Army aviation accident cases from the US Army Safety Center Aviation Safety Management Information System data base are provided to support discussion of each of the BQs discussed during the Aircrew Coordination Course. To assist unit instructors, the lesson plan refers to cases applicable to the BQs being discussed; after gaining experience in conducting the course, however, other examples may be preferred and used. Appendix D of the *Student Guide* mirrors this appendix except it lacks the instructor's case study discussion notes.

Appendix C - Grade Slips: Contains the modified grade slips to be used during initial aircrew coordination training. Because the grade slips used by the trainers and unit instructors to evaluate aircrew coordination are not reusable, they are provided as reproducibles. As such, sufficient numbers must be reproduced prior to the start of each new course and distributed as necessary.

Appendix D - Aircrew Coordination Evaluation Workshop: Practical exercises are provided to establish a consistent, standardized approach by unit instructors performing evaluations. Criterion-referenced standards in the form of behavioral rating guides will be used to achieve objective evaluator ratings.

Appendix E - Aircrew Coordination Evaluation Process: Contains the procedures for use by evaluators in evaluating aircrew coordination from the time the aircrew begins the premission planning process until the crew-level after-action review is completed.

Appendix F - Scenario Guidance: Contains guidelines for use by scenario developers. It is important that each scenario developed reflects the unit METL to effectively utilize training time available.

Appendix G - Practical Exercises: Contains hard copies of the reproducible practical exercises to be passed out to the aircrews during the Aircrew Coordination Course. The four practical exercises are Stress, Planning and Rehearsal, Hazardous Thought Patterns, and Communication. Because the exercises cannot be reused, they are provided as reproducibles and must be prepared in sufficient copies for each new course.

Student Guide

The *Student Guide* consists of an Introduction, the Student Handout, and supporting appendices. The Student Handout provides a valuable source of crew coordination information for use during continuation crew coordination training and crew readiness level performance checks. The appendices also contain supporting information necessary for instructor personnel to conduct either the Aircrew Coordination or Aircrew Coordination Trainer Courses. As a repository for supporting information discussed during the courses, the appendices allow for upgrading to reflect current information without having to rewrite the entire *Student Guide*. (Note: In that they cannot be reused and contain notes taken during the Aircrew Coordination Course for future reference, Sections 1 and 2 of the *Student Guide* are retained by the students upon completion of the course. Instructors must reproduce Sections 1 and 2 and insert them into the guides for use in the next course.)

Introducing the Student Guide: Explains the use of the *Student Guide* and the various sections and appendices.

Section 1 - Student Handout: The Student Handout is an outline form of the information contained in Section 3 of the *Instructor Guide*. Sufficient white space is provided for the training aircrews to take notes as unit instructors conduct the Aircrew Coordination Course. As such, the Student Handout is not reusable and is provided as a reproducible that must be copied in sufficient numbers for each new course.

Section 2 - Practical Exercises: This section is provided as a place-holder for each of the four practical exercises as they are completed.

Appendix A - Hangar Talk: This appendix is a place holder for trainers and instructors to store recent FLIGHTFAX or other aviation-related documents covering crew coordination. In this way, current information may be provided to the unit instructors or unit aircrews between updates of the Aircrew Coordination Exportable Training Package.

Appendix B - Crew Coordination Errors: Definitions and Examples: Contains Army aviation accidents organized by the six aircrew coordination errors outlined in TC 1-210 and the ATMs. It provides another source for accident cases and a different point of view for selecting accidents to highlight specific crew coordination principles.

Appendix C - Selected Accidents by ATM Task: Provides Army aviation accidents organized by the ATM task being performed immediately before the onset of the emergency precipitating the accident. As with Appendix B, it provides another point of view from which to discuss violations of specific crew coordination principles.

Appendix D - Aircrew Coordination Case Studies: Mirrors Appendix B of the *Instructor Guide* minus the instructor discussion notes. Contains narratives of Army aviation accidents that may be selected for analysis during the Aircrew Coordination Course.

Appendix E - Aircrew Coordination Training Evaluation Guide: Contains the evaluation instructions for use in conjunction with the modified Aircrew Coordination Training Grade Slips. The grading and rating systems, rating factors, and behavioral anchors are also explained.

Appendix F - Simulator or Flight Mission Materials: Provides a listing of the materials required for the simulator or flight missions flown during the Aircrew Coordination and Aircrew Coordination Trainer courses.

Appendix G - Background Reading: Selected readings in crew coordination are provided to add depth to the topics discussed during the Aircrew Coordination and Aircrew Coordination Trainer courses. Readings are cited in the Aircrew Coordination Course lesson plan and the read-aheads. Readings will be discussed during the first hour of instruction subsequent to their assignment.

The procedures involved in conducting the two courses included in the Aircrew Coordination Exportable Training Package are explained below.

Trainer Procedures for the Aircrew Coordination Trainer Course

The Aircrew Coordination Trainer Course is used to train unit instructors to present and evaluate the application of crew coordination principles embodied in the Aircrew Coordination Course.

Trainers presenting the Aircrew Coordination Trainer Course must do the following:

1. Review the Course Description, Training Aids Index, and Special Instructions starting on page xvii of the *Trainer Guide*.
2. Determine the number of unit instructors attending the course and obtain sufficient copies of the *Instructor Guide*, the *Student Guide*, and the reproducible sections of each to provide one set per unit instructor. Subsequent to the course, provide one set of audio-visual materials (viewgraphs and videotape) to each graduate or as determined by USAAVNC.
3. Arrange with the simulator facility to obtain "canned" scenarios that may be modified to reflect appropriate unit METLs, or develop METL-based scenarios for use during the Scenario Familiarization and Evaluation section of the course. Appendix F of the *Instructor Guide* provides guidance for the development of scenarios.
4. Develop a simulator or flight schedule that ensures:
 - a. The pretraining rides (Aircrew Coordination Course) are accomplished within the week prior to the course start date
 - b. The two training rides are accomplished within two weeks of the completion of classroom training (Aircrew Coordination Course)
 - c. The practice evaluation ride (Aircrew Coordination Trainer Course) is accomplished within two weeks of completing the scenario familiarization part of the Scenario Familiarization and Evaluation section.
5. Ensure that each unit instructor is provided Student Read-Ahead 1 at least one week prior to the pretraining ride, Student Read-Ahead 2 upon completing the pretraining ride, and the Instructor Read-Ahead at least one week prior to the course start date.

6. Conduct the course as scheduled. During the Aircrew Coordination Course, advise unit instructors to take notes on Section 3 of the *Instructor Guide* not on the Student Handout. Answer all pertinent unit instructor questions on the conduct of either course. Provide a telephonic contact point should any question arise subsequent to the course.
7. Ensure that an appropriate notation as to the completion of initial aircrew coordination training is made on each rated and nonrated unit instructor's flight record.

Instructor Procedures for the Aircrew Coordination Course

The Aircrew Coordination Course is used to train unit aircrews in the application of crew coordination principles to achieve the safe, efficient, and effective accomplishment of flying missions.

Unit instructors presenting the Aircrew Coordination Course must do the following:

1. Review the Course Description, Training Aids Index, and Special Instructions starting on page 3-1 of the *Instructor Guide*.
2. Determine the number of unit aircrews attending the course and obtain sufficient copies of the *Student Guide* and the reproducible items to provide one set per rated and nonrated crewmember.
3. Arrange with the simulator facility to obtain "canned" scenarios that may be modified to reflect appropriate unit METLs, or develop METL-based scenarios for use during Simulator or Flight Training. Appendix F of the *Instructor Guide* provides guidance for the development of scenarios.
4. Develop a simulator or flight schedule that ensures the pretraining rides are accomplished within two weeks prior to the course start date and that the two training rides and evaluation ride are accomplished within two weeks of the completion of Classroom Instruction.
5. Ensure that each rated and nonrated crewmember is provided:
 - a. Student Read-Ahead 1 at least one week prior to the pretraining ride
 - b. Student Read-Ahead 2 is provided upon completing the pretraining ride

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6. Conduct the course as scheduled. Advise crewmembers to take notes on the Student Handout and to store their completed practical exercises in Section 2. Inform crewmembers that Sections 1 and 2 are theirs to take but that the remainder of the *Student Guide* must be returned. Answer all pertinent crewmember questions about the course prior to releasing them to comply with the simulator or flight schedule. Provide a telephonic contact point should any question arise subsequent to the course.
 7. Ensure that an appropriate notation as to the completion of initial aircrew coordination training is made on each rated and nonrated crewmember's flight record.

Appendix L

BO Illustration Videotape Recommendations

CCO #1 - Establish and Maintain Team Relationships

Basic Quality	Crew #/pre- or Post-training/time	Vignette description
Good Crew Climate	#9/Post-training 1:08:45-1:12:45	While planning instrument approach, crew review procedures and verify information provided by each other in a professional and supportive climate
Poor Crew Climate	#14/Pre-training 41:35-42:10	After P* turns past heading P directed, P tells him to turn back to left; P* turns too slowly and P reaches down and moves cyclic to increase bank angle

CCO #2 - Mission Planning and Rehearsal

Basic Quality	Crew #/Pre- or Post-training/time	Vignette description
Good Premission Planning (in-cockpit)	#5/Post-training 14:40-16:45	While preparing for the cross-FLOT portion of the mission, crew reviews and rehearses critical aspects of next segment and briefs CE with good interaction among the crew
Poor Premission Planning (in-cockpit)	#14/Pre-training 32:00-29:28-32:00	While preparing for the cross-FLOT portion of the mission, crew has very little interaction; few questions asked or answered; not a very cordial mood

CCO #3 - Establish and Maintain Workload Levels

Basic Quality	Crew #/Pre- or Post-training/time	Vignette description
Good Management of Unexpected Events and Prioritizing Actions and Distributing Workload	#9/Post-training 6:30-8:15	Crew interacts well together while coping with an emergency and maintaining orientation; good decision by P to land in PZ
Poor Management of Unexpected Events and Prioritizing Actions and Distributing Workload	#9/Pre-training 5:45-8:45	Crew is very slow to handle emergency just prior to PZ; P becomes preoccupied with emergency procedures; crew flies past PZ and gets lost

CCO #4 - Exchange Mission Information

Basic Quality	Crew #/Pre- or Post-training/time	Vignette description
Good Positive Communications and Communicating and Acknowledging Decisions and Actions	#10/Post-training 13:50-17:00	During terrain flight with external load, crew provides and acknowledges critical information and interacts well
Poor Positive Communications and Support Information Sought	#10/Pre-training 57:00-59:15	During external load terrain flight, crew has very little interaction; P* seldom acknowledges information from P

CCO #5 - Cross Monitor Performance

Basic Quality	Crew #/Pre- or Post-training/time	Vignette description
Good Cross-monitoring of Actions	#3/Post-training 1:21-:30-1:22:30	During instrument flight, P monitors and corrects P* twice when his altitude deviates beyond standard
Poor Cross-monitoring of Actions	#6/Pre-training 1:18-19-1:19:36	Crew flew into rising terrain 1:19:34 after initiating VHIRP; P* was slow to climb and made turn toward mountains too early; P warned P* about rate of climb
Poor After-Action Review	#9/Pre-training 0:00-8:22	Crew conducts cursory review of flight segments; not much discussion on msn objectives, standards, and lesson learned
Good After-Action Review	#9/Post-training 0:00-34:30	Crew conducts detailed review of all segments of msn including planning phase; discussion centered on msn objectives, performance standards, and lessons learned with all crewmembers including CE participating

Appendix M

Evaluation Workshop Practical Exercise Videotape Recommendations

Appendix M

Evaluation Workshop Practical Exercise Videotape Recommendations

Segment	Crew # Pre-, Post-training Elapsed time	Segment description	Evaluation practical exercise #
1	#10; Pretraining 57:00 - 58:50	Air movement external load, terrain flight navigation	Exercise #3 Negative example
2	#10; Posttraining 14:12 - 16:20	Air movement external load, terrain flight navigation	Exercise #4 Positive example
3	#5; Posttraining 18:10 - 23:20	Air assault planning and rehearsal	Exercise #5 Positive example
4	#16; Pretraining 45:35 - 46:21	Air assault, threat evasion	Exercise #6 Negative example
5	#14; Posttraining 50:35 - 53:35	Air assault, LZ arrival	Example #7 Negative example

Legend:

Segment -- The sequential number of the recommended segment

Crew #; Pre-, Posttraining; Elapsed Time: The number of the testbed crew, whether the videotape was filmed during the pretraining or posttraining evaluation mission, and the footage recommended as the segment for the workshop videotape.

Segment Description: What the crew was doing during the recommended footage.

Evaluation Practical Exercise #: The Aircrew Coordination Evaluation Workshop exercise number and whether the segment serves as a negative or positive example of crew coordination.